

Photos: Simon J. de Waard

Grinding and honing. Part 1

INFO 20M

Information for ship and tool-lovers

INFO 20M
Information paper great pleasure boats and toollovers

The paper "great pleasure boats" is meant for owners, skippers and other interested parties of recreational vessels over 20 meters such as:
- Former inland vessels
- Former Marine vessels
- Former fishing vessels
- Former Navy ships
- Former tugs and pushboats
- Houseboats
- Recreational vessels specifically built for that purpose.

The magazine INFO-20M "great pleasure boats" provides this target group with information about nautical law and the (technical) equipment on board the ship.

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Introduction

This is a paper, using a historical context, about the almost lost techniques of sanding, grinding and honing of tools in the series:

The tricks of the trade.

We live in a time where craft is becoming less important. Much knowledge is lost and although today we can find much on the internet it is unfortunate to note that the old (professional) knowledge is poorly represented there.

This special describes techniques and related pieces of information from the transition period that predates the industrial age and which are at risk of getting lost. One of the most important skills a woodworker must have is the ability to sharpen tools properly and easily.

Working with hand tools can be a frustrating experience, unless your tools are perfectly sharp.

The sharper the tool, the less force is needed to handle it. It is easier to sharpen the tool than to sand the work piece...

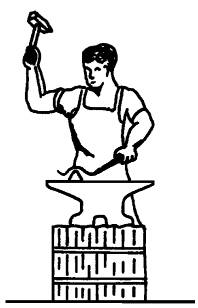
Henk Bos

Contents of part 1

Contents of part 2 (May 2012)

Contents of Part 3 (May 2013).

This part will come about in a 1 year's time (May 2013).





Coticule museum at Lierneux.

Grinding and Honing
The stone of Bertus Meier

Introduction

We live in a time that craft is becoming less important. Much knowledge is lost and although today we can find much on the Internet it is unfortunate to note that the old (professional) knowledge is poorly represented there. As a boy I seem to have been something of a nuisance who grew up in a village where the relics of various trades were still present. There were sailmakers, a ropewalk, several blacksmiths, shoemakers, carpenters and painters who were mixing their own paint. I always asked the question "why is this" and "why do you do things this way", etc. Fortunately, the tradesmen were also patient and did not hesitate to explain when again I overwhelmed them with questions. Today's factory made sharpening stones are often better, more consistent and give a faster result. Thus old knowledge is lost. This story is meant to - as far as I know - capture that knowledge and give an overview of the natural abrasives, grinding and sharpening stones.

How and why of the search



In the White House lived Carpenter Bertus Meijer

You are lucky as a little boy, when you have a neighbour who is a carpenter, with a workshop with machinery, wood and shavings. Nice golden curls with a beautiful satin glow, cut by the sharp iron of the jointer plane. It is an ideal environment for a young boy, but also a place where the impressions are deeply carved into your memory.
One of the clearest impressions is that Bert one afternoon was grinding planeirons and chisels on a large hand-driven sandstone mounted in a wooden box. The wooden box was full of water.
Now, water has always been a great attraction to me, so my interest was immediately aroused.
After grinding on the large sandstone a stool was drawn up and a wooden box pulled out.
In the box was a stone and guess what ... Bert spat on it!
And then the question: "Berrus why is that?"
And then Bert told about grinding the bevel and about honing it on a piece of Belgian stone. All jargon then unknown but which because of the situation still lingers in the memory. Much later, the deeper meaning will reveal itself.



The sail maker of the "Zuiderzee" museum grinds his knife on a sandstone

It is a lucky coincidence to have an uncle who is a carpenter when you are a little boy. Uncle Hendrik Raatjes had a beauty of a workbench with a tool box in my grandfather's barn. When that uncle also makes a miniature dump-cart for you, your interest is aroused. Especially the toolbox was interesting. Every carpenter has personal tools he cherishes and keeps as sharp as possible.

And yes, here too was a stone with two colours. You will not rest before having a good look at the stone and of course also spitting on it.



A Belgian stone in the museum at Borgercompascuum owned by a Cartwright.

Years later, you're just married and starting to build your own shop. You can buy the all chisels, gouges, both in-cannel and out-cannel, as well as all moulding planes from a retiring carpenter.
But then the problem arises ... How to get them sharp!

Oh, you think, just get a Belgian stone from the hardware store. Then you realize that some things have changed. The Belgian stone is no more, it has been replaced by a synthetic product, pressed into a rectangular shape. Because there is nothing else you buy it. At home that tool proves to be not as perfect as you would like and the search begins.

We looked around all hardware stores in the neighbourhood and during the holidays we visited hardware stores in all major cities. The family knows now: there is no escape. Every time I look at the tools available and for whetstones. Occasionally, I bought a whetstone, but after trying it out, it does not seem to be giving the perfect edge I am looking for. After all, a perfectly sharpened chisel grips your fingernail held at an angle without slipping off! All data we collected during our trips are entered in a data base.
Our starting point in every store is: "Do you have a Belgian stone?" After all, that is all we know.

It is typical that all elderly people in a hardware store know the stone and that the stone has a good reputation. To young people the stone is completely unknown.

One reason for its demise, I think, is its long life.
A whetstone of good quality certainly lasts for more than fifty years. A high turnover is becoming difficult that way. The fact that the stone is quarried by hand and must be processed easily makes it more expensive than artificial stones.

And then one day you meet your neighbor Willem Vader who lives two doors away. The conversation is about our hobbies. It turns out that Willem is a mineral collector.
I ask the habitual question: "Willem, do you know what is a Belgian stone?" To your amazement he says: "Yes, that's coticule!"

It appears that all the answers are available, including locations and maps of the area where it is found.

So a few weeks later we start out with our mini camper to the area around Vielsalm and fall from one surprise into another.
A part of our findings and notes from the collected data we would like to share with you.

A trip to Petit Sart (Lierneux)



Since our marriage in 1966 my wife and I regularly make a little trip. We had a little Suzuki pickup we could just sleep in. These trips came to be called 'Honeymoon' in our family. It is nice now and again for the two of us to go out on our own. This kind of trip is perfect to obtain information or do some research. So in the autumn of 1986 we took the information from Willem Vader and went out to see what was left of the whetstone culture in the Belgian Ardennes.

A well-known importer of whet- and grinding stones, Mr. Groenendijk Sr. in Enschede had told us that he had bought the remnant remaining stock of Belgian stones from the company Burton Lierneux, after the death of the owner. Using our map, we visited a mine, found a museum and two years later the company Burton Rox! In the museum you could even buy whetstones. Our main goal was achieved and so we went home satisfied.

Musee du Coticule



This interesting museum is located in Salmchâteau and is called: Musée du Coticule. The museum is located in an old (restored) coticule workshop at a creek called the Glain and has been open since June 1982.
The first section provides an overview of rocks and minerals that can be found in the Salm region. The second section contains an exhibition of documents and workshops that illustrates the historical, social and commercial importance of this industry.
The final part consists of the original workshop.
All machines are still present and can be used for demonstrations.



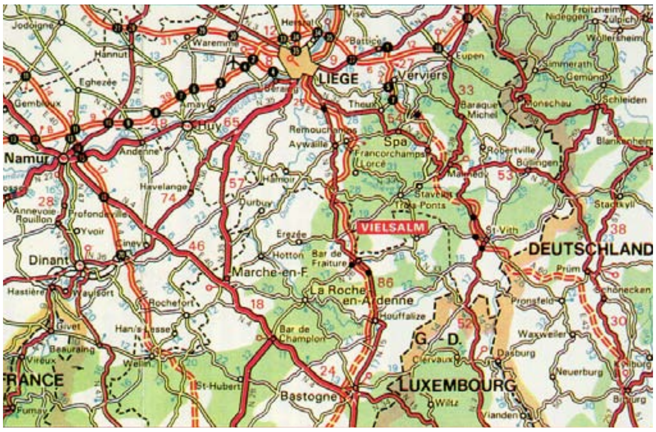
The address is N 50.26123º, E 005.90526º:
Musée du Coticule, Salmchâteau - 6690 Vielsalm.
Tel 32 (080) 21.57.68
Open from April 1 until the last Sunday of the Autumn school holiday, from 10-12 am and 13-17 pm.
On Sunday from 14 to 17:30 hours
From November 1 to March 31 by appointment.
Closed on Mondays.
Correspondence may be addressed to: Robert Nizet, Administrator, 4 Rue du Vieux Marché, 6690 Vielsalm.
museeducoticule@skynet.be

In the summer of 1988 we made an extensive tour with the family to Douarnenez. After hearing our stories the children also wanted to see where the stones came from in Belgium. So our route took us through the Ardennes. We visited the museum and on the way back we noticed at the side of the road a small purple sign that said "Souvenirs du Coticule". So we stopped immediately and followed the sign. At the destination, we found a few historical buildings and an open door. We looked inside and with an inviting gesture, we were asked to come in and look around.



None of the people present spoke Dutch and unfortunately our French is not what it should be. With one phone call the problem was solved and so we met Joseph Grogna who showed us around and answered our questions.

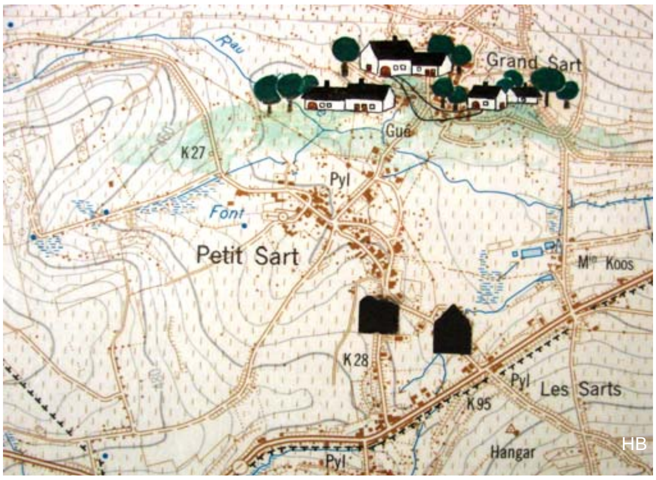
Occurrence of Coticule (Belgian stone)
Petit-Sart, Lierneux, Vallée de la Lienne, Massif de Stavelot, Province de Liège, Belgique.
South of the Cambrian massif of Stavelot flows in the river Salm next to which are located the towns Salmchâteau and Vielsalm.



The municipality of Vielsalm is located some fifty kilometres southeast of Liege, and to geologists and lovers of mineralogical curiosities is renowned for its mineral metamorphosis. Some, like Arden or Ottreliet, even enjoy an international reputation.
The history of coticule mines in the Belgian Ardennes has been proven to exist since1625. The occurrence of Coticule is a geological rarity. Apart from Belgium, Coticule only occurs in Namibia, in the region Kaokoland.







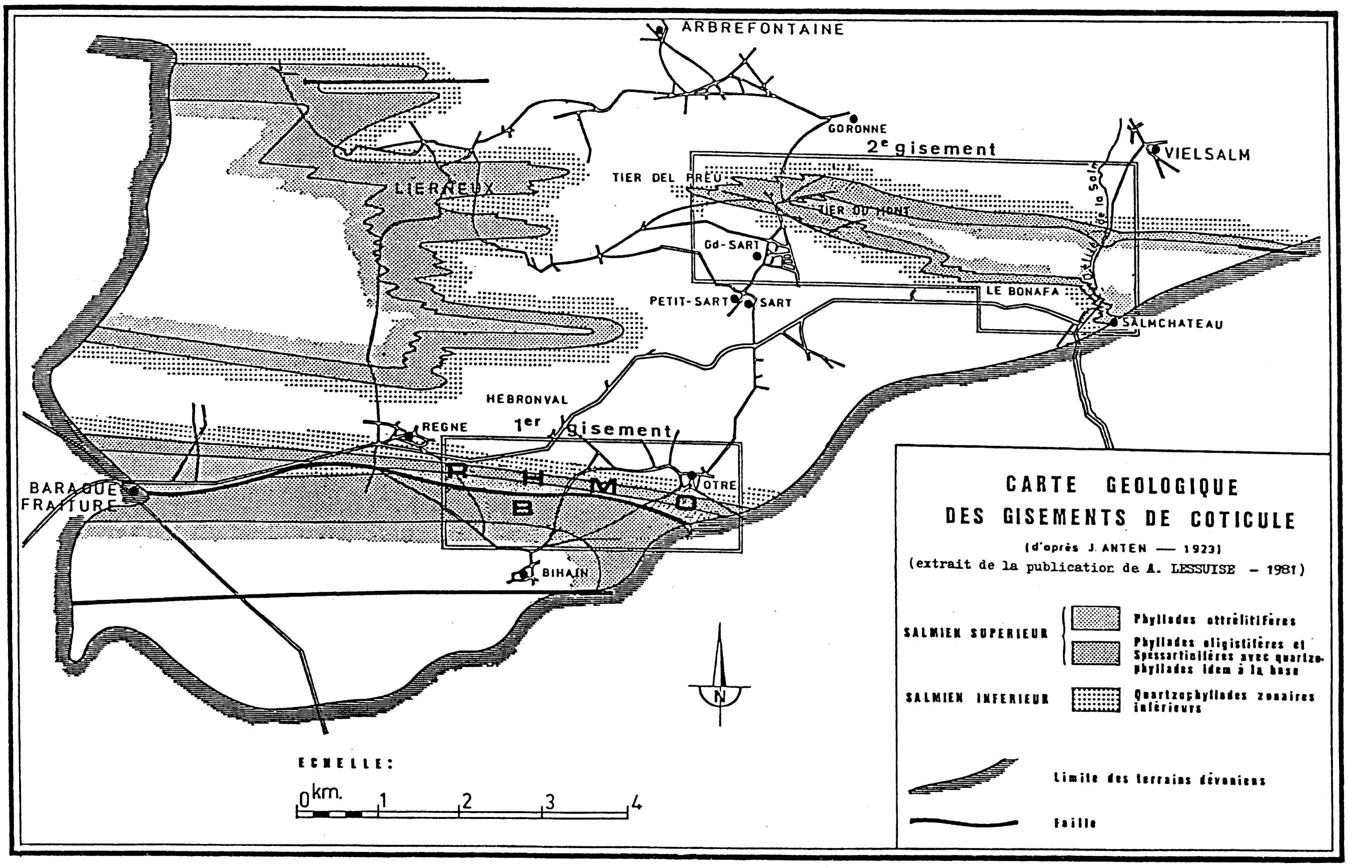
Coticule is a yellow compact metamorphic rock composed of many minerals. Density is 3.22 g/cm3. It occurs in layers of 2 mm to 25 cm.

In the deep parts of the Basin of Vielsalm silt and clay were deposited in the early Ordovician (~ 480 million years ago) which is enriched with iron and manganese. Clay consists of rock fragments of less than 0.002 mm in size. Within the classification of grain size and texture of a sediment the faction from 0.002 to 0.0063 mm is represented by silt. Clay and silt have a particle size substantially smaller than the grains of sand. The iron and manganese probably stem from volcanic activity.

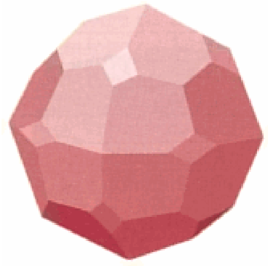
The rock is found in a limited area and is separated from the environment by two fault lines. The rock formations divided by these fault lines have an age difference of 150 million years!

The names of the ingredients are spessartite [Mn3Al2 (SiO4) 3], cerizite and quartz, for the best types of rock each for 1/3. Spessartite is a manganese-aluminum-garnet. Colour: orange to reddish brown, hardness 7-7.5 and a specific gravity of 4.12 to 4.20 kg/dm3.





Spessartite is named after the former location Spessart (DDR).
Cerizite consists of muscovite and paragonite in a 2:1 ratio with the addition of 0-1% chlorite and 0-2% kaolinite.
For use as a whetstone, the tiny particles of garnet (5-20 microns) are important. The garnet particles are surrounded by mica and quartz. In terms of hardness, garnet comes after diamond, codundum, and topaz.



Like a football, the surface is divided into facets (Rhombendodekaeder). What makes this stone so excellent as a whetstone is its roundness with small pointed outcroppings combined with its hardness (see chapter 2 polishing).
Due to the high degree of hardness of the garnet particles also hard steel can be sharpened.

The end of the traditional mining in 1980
The coticule was found and mined in the following areas: Salmchâteau, Ottré, Regne Hébronval, in the north of the province of Luxembourg and Sart-Lierneux in the south of the province of Liege.
Already Plinius the Elder writes in his great work "Natural History" that very special sharpening stones were found in the area west of Trier. The first mining activity dates from the early 16th century and reached a peak in the 19th century.
As a result of technical development and the emergence of the artificial whetstones the consumer market got smaller and in the years from 1950 to 1970 one mine, quarry and or workshop after the other closed.
The last mine was abandoned in 1980 and closed after the death of the entrepreneur, Burton, in 1982.

A new beginning 1986

BURTON-ROX S.A.
BR
MADE IN BELGIUM

In 1986, two young geologists, Joseph Grogna and Andre Lesuisse in cooperation with the municipality Lierneux and the Burton family started a feasibility study. Following that the production of whetstones was revived with modern tools and techniques. Meanwhile, the SA-Burton-Rox was founded and working continuously with 5 people.
Sales also got underway and the products were again sent throughout the world (including Israel and Brazil).



The raw material in the quarry is made loose by using black powder and brought from the quarry to the workshop for further processing.



In the historical shop, pieces of coticule are cut into usable parts with a diamond saw and polished.



The coticule not always comes with a sufficiently thick layer of blue-violet "Rouge de Salm". Using Araldite (2 comp. Epoxy glue) it is glued to a piece of Rouge de Salm. In ancient times Lorraine was used.
Rouge de la Salm also has a very good grinding effect by the garnet grains (in the amount of 20 to 40 microns) contained therein.

Another new beginning 1998

ARDENNES
Coticule

After an good start initially, by 1998, the company was not doing well. Maurice Celis (mining engineer) then took over the company and called it Coticule Ardennes.
The company is now formed by Maurice Celis, his son Rob Celis (engineer), a geologist and a few employees.



Video:
http://www.streamingkit.de/player/st...erBrocken1.asx
The video was made by a German importer.

Due to the great interest in the "Belgian stone" there is only a small stock and for some qualities allied with a required size, there is a delivery time of approximately one year. This leads to rising prices.







In early days levelling the stones was done on a cast iron disk with sand and water. They called it levelling but the technique is "lapping". Nowadays the stones are levelled on a diamond disk.

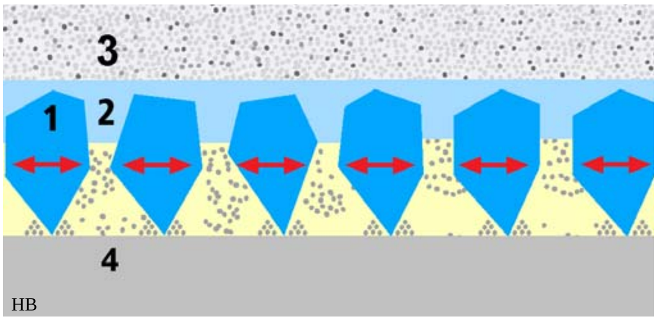
Grinding and honing chapter 2
Sanding, grinding and lapping

Introduction

There is a fundamental difference between the operations. It is important to understand how it works. Especially the effect of the lapping is interesting in order to understand how it is possible that a Belgian stone produces such a perfect cutting edge appreciated by everybody.

Sanding

Sanding is a machining technique in which an abrasive is rubbed across a surface. The abrasive is harder than the surface material and thus this is decreased, especially in order to get a smoother surface, but also in order to roughen a smooth surface or to remove some material in a controlled way.
In most applications, the hard grains are mounted on a flexible substrate. This can be foam but also linen, paper or fibre. The name usually says more about the basic material than about the grains. For example, scouring pad, fibre sanding disc or belt.



The drawing shows the grain (1) and the elastic adhesive layer (2) that binds it to the flexible support (3).

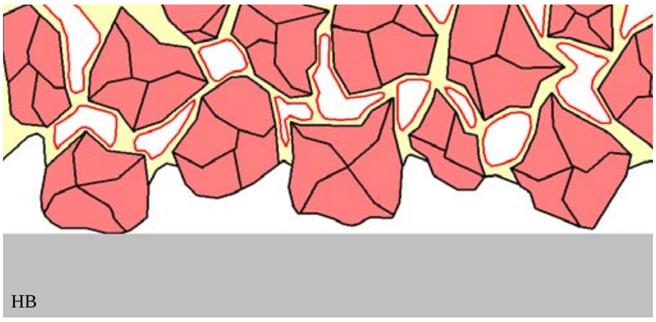


The hallmark of an abrasive is that the pressure on all grains in contact with the work piece (4) is equal everywhere.
This manifests itself in a uniform pattern of equally deep grooves.
For more information on abrasive products, the Internet is a great resource. There is plenty to find.

Grinding

Within a rotating sharpening stone, the grains are held together by means of a rigid binder. In a sandstone the grains or cemented rock particles are held together by a kind of cement composed of calcite, clay and silica.

Also in man-made corundum or carborundum stones the grains are joined together by a bond that depends on the application. Usually they are bonded with ceramic material. This means that some sort of clay such as kaolin is mixed with particles, compressed in some form, dried and then baked. There are many bonding materials (yellow) possible.



In the same way hone stones can also be made.
One advantage is that the quality is constant and there are many grains possible.

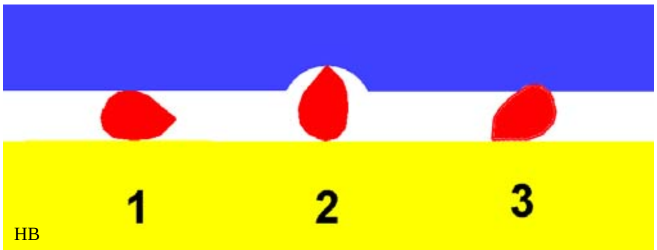


HB0098 Segro Sebald Aluminum K180

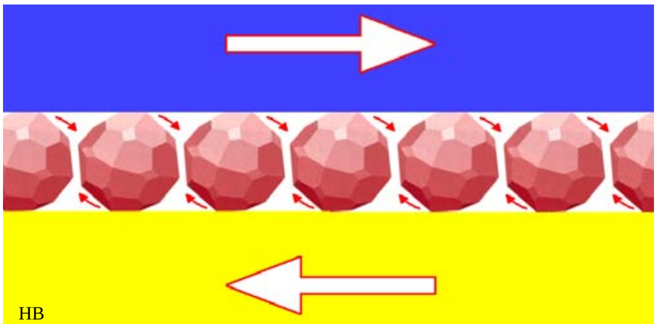
The characteristic of a grinding stone is that the pressure on the grains is not equal in size. This means that not all grinding grooves are of the same depth. Its depth depends on the size of the grains and the applied pressure.
Especially the pressure is important. With the same stone, a coarse or a fine appearance can be obtained by changing the pressure! The nature of the grains and their application is discussed in chapter 3.

Lapping

Lapping is defined according to DIN 8589 as follows:
Lapping is a machining operation where abrasive particles contained in a paste or a liquid, the lapping compound, is put on a carrier to work the piece. The essence of lapping is that an abrasive is put on a hard surface in the form of a slurry.
The particles cannot be pressed into the surface and become lodged, so they roll freely in all directions.
They ram small particles from the surface of the work piece causing a deep deformation.
This happens because it is not possible for the moving particles to take a real "chip" out of the work piece.

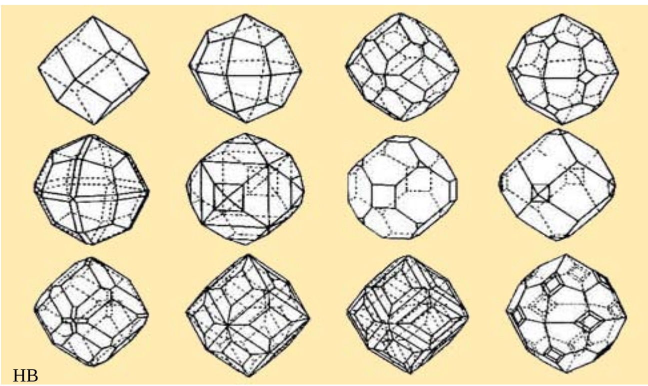


The three positions of an rolling abrasive particle that passes the work piece.
Position 1: The grain reaches the specimen surface.
Position 2: The particle rolls and slams out a piece of material. By means of the "hammer effect" a deep deformation appears in the material of the specimen.
Position 3: Particles roll on without touching the surface of the specimen. When the particle passes the specimen once again a smaller or larger bit is hammered out, depending on the shape of the particle.

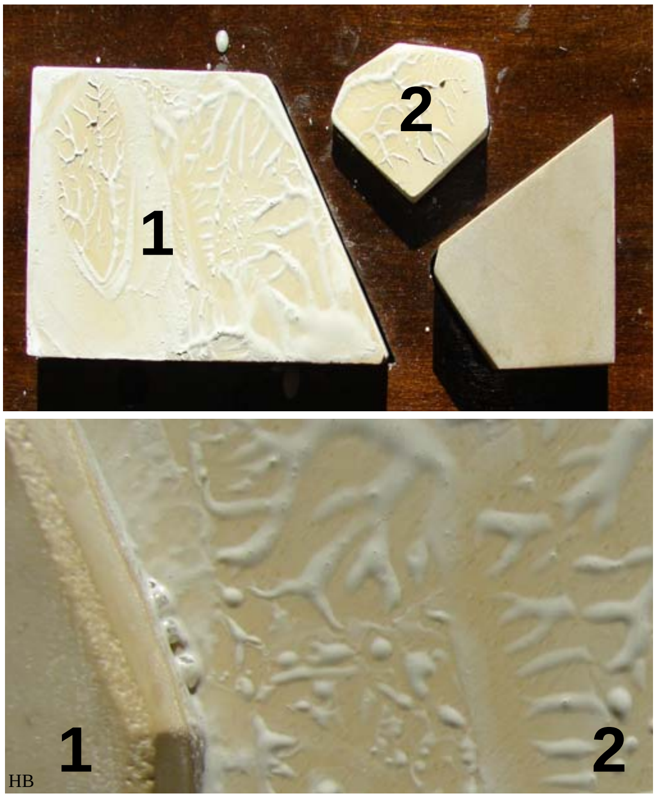


Läpping with perfect garnet crystals

The method of lapping is used with a Belgian whetstone and to a slightly lesser extent with the Thuringian.
The yellow Belgian hone - Coticule - contains 35 - 40% garnets with a grain size of 5 to 20 microns; this corresponds to a grit of 6000 á 8000. The garnets have a hardness of 7 to 8 on Mohs scale.



Crystal forms in garnet



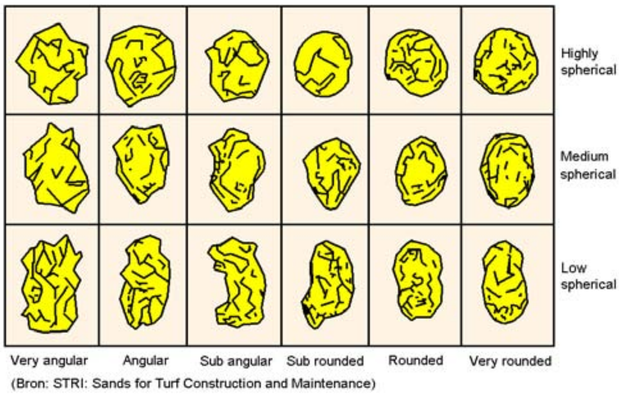
Top: my whetstone set with Belgian stones. The stones are mounted in an Aboachi box, a wood that is relatively soft and easy to work.

In comparison: quartz has relative hardness of 7, most glimmers a relative hardness of 2 to 4 and a pocket knife has a hardness of 6 to 6.5 on the Mohs' scale.

The form of most garnets is a dodecagon (12 sides).
This shape of tiny high points combined with its hardness produces an extremely smooth surface.

The honing process: a stone is moistened with water (the best result is achieved by spitting on it) and the milk stone 2 is rubbed across the surface of stone 1 to create a milky substance.
This slurry is used during honing in order to get the tool perfectly sharp.

Particle shape



The shape of the particles and the pressure determines the final appearance and the sharpness of the cutting edge.

In the early phase greater force may be used, while during the last strokes very little force is desirable.

Grit comparison of grindstones and hones

The first thing everyone asks is: what is the grit of a whetstone. It would be easy if we were able to give an unequivocal answer to this question. Unfortunately, many different classifications are used such as European, English, American and Japanese. To clarify the picture I made the following table.
The numbers define the size of the particles and correspond to the number of threads per inch, which make up a sieve. Common numbers are 10, 12, 14, 16, 18, 20, 24, 30, 36, 40, 46, 54, 60, 70, 80, 90, 100, 120, 150, 180, and 200. Particles smaller than 200 are called "flour" and get the leading letter F. The diameter of the F classifications is often not standard and may have a small deviation depending on the source.
The classifications of the natural stones such as Arkansas, coticule, Belgian blue and others are average as there is considerable differentiation between the stones.
It is impossible to make an exact comparison between the various standards and the tolerances thereof. Therefore, the table is meant to help understand…

Explanation of terms
FEPA (Federation Europeenne des Fabricants de Produits Abrasifs): the European association of manufacturers of abrasive material. They differentiate between grits on paper (FEPA P) and grits in grind- or -whetstones (FEPA F).
The classification is determined by the F-prefix
JIS (Japanese Industrial Standard): the classification of the Japanese standard board.
ANSI (American National Standards Institute): classification of the American institute.
MICRON (μ) is the letter "mu" in the Greek alphabet and indicates a dimension. μ is a thousandth of a millimeter (0.001 mm).
This term is used to provide a common denominator for the above classifications and put them in the right order.

Micron	Fepa A Europ Din 69101 1985	ANSI (USA) B74;10 1977 R1988	JIS Japan R6001 1998 old	JIS Japan R6001 1998 New	Trade names and types of stones, grinding, and abrasive materials
2210		8			
1854		10			
1764	P12				
1600		12			
1322	P16				
1092		16			
984	P20				
940		20			
740	P24				
686		24			
622	P30				
559		30			
524	P36				
483		36			
412	P40				
356		46			
326	P50				
305		54			
260	P60				
254		60			
203		70			
195	P80				
180					Lansky Extra Coarse Hone; Coarse Scotch-Brite Belt/Pad
165		80			
156	P100				
145		90			

127	P120				Norton Coarse Crystolon (The Norton designation for Silicon Carbide)
122		100			Shapton Pro 120 grit; DMT Extra Coarse
110					**Arato** (Natural Sandstone Or Carborundum); Lansky Course Hone
102		120			
97	P150				Norton Coarse India (The Norton designation for Aluminum Oxide)
89		150			Medium Crystolon (Silicon Carbide); Coarse India; Medium Scotch-Brite Belt/Pad
80					Fine Scotch-Brite Belt/Pad
78	P180				Norton Medium Crystolon
76		180			
65	P220				Shapton Pro; Glas 220 grit; 220 grid
63		220			
60		240			Shapton 240; Binsui Coarse Stone; Extra Coarse Diamond Hone; Very Fine Scotch-Brite Belt/Pad
58	P240				
57		240			
53	P280				F230; Norton Medium India
52.5			280		Shapton 280 grid
50			240		
48				280	
46	P320		320		Norton 360 Water Stone
45	F240				Norton fine Crystolon; DMT Coarse; Medium India; Fine Crystolon (Silicon Carbide); Coarse Diamond; Lansky Medium Hone
40	P360		360	320	
39		280			
36	F280				Norton 360 grit Water Stone
35	P400			360	Norton Fine India; **Kaisei** (Natural Sandstone); Medium Diamond; Super/Extra Fine Scotch-Brite Belt/Pad; **Mashiro Arato**
34			400		
31		320			
30	P500			400	Shapton Glas 500 grit
29	F320				
28			500		
25.8	P600				
25				500	**Chu-Nagura**; **Washita Stone**; Fine Diamond; DMT Fine
24			600		Shapton 600 grit
23	F360				
22	P800	400			Norton 600 grit Water Stone
21			700		Shapton 700 grit
20					**Soft Arkansas**; Lansky Fine Hone; Ultra Fine Scotch-Brite Pad; Spyderco Medium Ceramic
19				600	
18	P1000		800		Shapton 800 grit
17	F400			700	
16		600			Norton 800 grit Water Stone
15.5			1000		
15	P1200				Shapton Pro & Glass 1000 grit; **Koma-Nagura**; **Hard White Arkansas**; Extra Fine Diamond; Medium Ceramic; Moor Black Ceramic; **Masahiro Nakato**
14		700		800	Norton 1000 grit Water Stone

13	F500		1200		
12.6	P1500				
12		800			Shapton 1200 grit
11.5				1000	
11					Norton 1200 grit Water Stone; **Hard White Arkansas**
10.8					**Queer Creek Blue Ohio Sandstone**
10.5			1500		
10.3	P2000				
10					3M 10 micron diamond stone; **Hard Black Arkansas**; Extra-Fine Diamond Hone; Lansky Ultra-Fine Hone
9.8					
9.5				1200	
9.2	F600				Norton 1500 grit Water Stone
9		900			DMT Extra Fine
8.5			2000		
8.4	P2500				
8				1500	
7.5					Norton 2000 Grit Water Stone
7.35					Shapton Pro & Glass 2000 grit
7		1000			DMT Ceramic
6.7				2000	
6.5	F800				
6					**Hard Black Arkansas & Translucent Arkansas**; Norton 4000 grit Water Stone; **Ao-To** (Blue Stone); Spyderco Fine Ceramic
5.88					Shapton 2500 grit
5.7			3000		
5.5				2500	Canadian Natural Slate Sharpening Stone
5	F1000	1200			5 micron SiC paper
4.9					Shapton 3000 grit
4				3000	**Belgian Blue stone** (Approximate) Naniwa Super Stone
3.68					Shapton Glass 4000 grit
3	F1200	1500		4000	Norton 8000 grit Water Stone; **Uchigumori**; Extra Fine White Ceramic; Chroomoxide groen; Rouge; Spyderco Extra Fine Ceramic; Spyderco Ultrafine
2.94					Shapton Pro 5000 grit
2.45					Shapton 6000 grit
2	F1500			6000	**Karasu** (Blue Stone); **Awasi Toshi**
1.84					Shapton Pro & Glass 8000 grit
1.47					Shapton 10.000 grit
1.2	F2000			8000	**Belgian Yellow coticule stone** (Approximate); Shapton Pro 12.000 grit
1		2000			**Honyama Awasi** (Brown Stone); Linde C Compound (Aluminum Oxide Powder)
0.98					Shapton Pro 15.000 grit
0.92					Shapton Glass 16.000 grit
0.74					Shapton 20.000 grit
0.5					Norton 15.000 Water Stone; Chromium oxide polishing compound; 0.5 Chroomoxide paper; More white ceramic

The natural stones are printed Bold.

Mohs Hardness	Mineral	Absolute Hardness	'Scratch information'	Brinell Hardness
1	Talc (Mg3Si4O10(OH)2)	1	The softest mineral. Each of the other will scratch it. Possible to scratch with fingernail. A stone with hardness 1, will leave a line on paper.	3
2	Gypsum (CaSO4·2H2O)	2	To be scratched with a fingernail.	12
3	Calcite (CaCO3)	9	Scratch able with a copper coin, easily been cut with a steel blade.	53
4	Fluorite (CaF2)	21	Easily scratch able with knife.	64
5	Apatite ($Ca_5(PO_4)_3$(OH-,Cl-,F-))	48	With knife scratching. (Enamel Apatite is the hardest substance in our body). Glass or a nail can scratch hardness of minerals to 5.5	137
6	Orthoclase (KAlSi3O8)	72	Hardly scratch able with a knife, with a steel file slightly scratch approx. Hardness from 5.5. allows the stone to scratch glass	147
7	Quartz (SiO2)	100	Scratches window glass, steel, copper and most other substances.	178
8	Topaz (Al_2SiO_4(OH-,F-)$_2$)	200	Scratches Quartz.	304
9	Corundum (Al2O3)	400	Scratches Topaz. (Corundum is better known in the varieties of sapphire and ruby)	667
10	Diamond (C)	1500	Scratches corundum. The hardest of all known natural substances.	

Friedrich Mohs (January 29th 1773 - September 29th 1839) was German geologist* / mineralogist*. Born in Genrode Germany. Went in 1802 to Australia where he tried to identify a collection of minerals belonging to a banker by their physical appearance rather than their chemical composition. Although the hardness scale is empirical, it is vital when doing fieldwork on minerals. It is one of the tools for mineral identification, without having to resort to retrospective analysis in a laboratory. The hardness is determined by what material causes a scratch in another.
The highest value 10.0 is assigned to diamond. With diamond any other substance can be scratched. Boron nitride BN for instance is slightly softer than diamond but harder than all subsequent solids, it has a hardness of 9.8.
Mohs selected ten familiar minerals for his scale but subsequent measurements revealed that his scale is not linear. In a laboratory one can determine the absolute hardness with a sclerometer*.

Geologist: Expert on the physical history of the earth, the rock it consists of and the physical changes it is and has been subjected to.

Mineralogist: Expert on minerals, ores and stones

Sclerometer: (Greek skleros: hard) an instrument for a mineralogist to measure the hardness of materials (using the Mohs' scale). With the instrument a diamond point applies increasing pressure to a surface.
The pressure that causes an impression is proportional to the hardness.



Open-air museum Bunge on the isle of Gotland on June 20th 2010. Photo: Maarten Arend


Pannenrood
Puimsteen
Naxos korund
Chroomoxide 1 micron
Uitgeester dakpan
Dodekop rood
Weense kalk
Emery
Groninger baksteen
Beenzwart
Kalk
Levantiner
Bikzand
Houtas
Tripoli
Smirgel
Zilverzand
Groninger klei
Tonder zwam
Amaril
HB

Grinding and honing chapter 3

Sand, soap, soda



Introduction

Sand, soda, soap: for many a familiar expression. It is a pity that the knowledge and skills that hide behind this expression are getting lost. Even if you encounter anything like this in museums, the attendants cannot tell what was done with it and why. The knife-board certainly is has completely vanished from sight. In this story, I will tell you what I remember from the time some 60 years ago.



Soda, sodium carbonate in chemistry, is a sort of salt, on the market in the form of a white solid substance.
It is a so-called alkaline product that can dissolve fat and grease that are acidic in nature.

Soda was called in the Middle Ages by the Latin word Sodanum, which is a derivation of the Arabic Sudá. Sodanum literally means a remedy against headache and the Arab Sudá means headache.

There are several types:



* **Soda ash** (washing soda)
Household soda is still a tried and cheap detergent. In Holland the most well known manufacturer is called "Driehoek".
For sale in supermarkets it is used to remove stains (oil, wax, etc.), for degreasing, disinfecting and to soften water.
This cleaning agent can cause skin irritation, so wear rubber gloves. Perhaps Soda is one of the oldest detergents.
It occurs naturally in mineral springs and in the ashes of many marine plants. The soda that you, fortunately, still can buy at your grocery store, is produced industrially from ammonia, carbon dioxide and kitchen salt.



* **Bicarbonate of soda** (baking soda)
For sale in the supermarket. This type of soda is also added to foods under an E number: E500. It is a white crystalline compound used as a leavening agent in baking powder instead of yeast. It is also used as a mild cleaner or abrasive, especially in the domestic sphere in England, and as baking soda, a component of antacids for heartburn. When mixed with a strong or weak acid it decomposes, and in the process releases carbon dioxide. Previously people used it to create the bubbles in a drink, also known as soda water.

This soda can be used for various tasks such as cleaning, disinfecting, etc. For example:
Mix baking soda with the juice of a lemon and you have found a great remedy to clean your enamel bath tub.
Wearing gloves during this operation is however highly recommended.

* **Borax** (boric acid or soda).
Usually Borax is usually available in the supermarket.
You can use it to clean, disinfect and lightly bleach.
Additionally, you can use it to chase away vermin.
Borax is moderately toxic, do not eat it, don't use it on surfaces where food is prepared and wear gloves if you have a sensitive skin.



Cleaning always has been a daily activity for many. Sand, soap, soda (and also ammonia) are products that have a long history as cleaning agents.

Soap, besides sand and soda, the third very old cleaner, was in use in the Old World long before the birth of Christ. Soap is a product that takes on many forms and is still being made and used: as a liquid, a gel, granules or flakes, as a block or in pieces. The first brands in the UK came in the last decades of the nineteenth century. SUNLIGHT ® was registered in 1884 by William Hesketh Lever (the son of a grocer) and his company Lever Brothers who in 1886 started to make soap on a commercial basis.
In the Netherlands, on October 15, 1913 Lever's Soap Company (LZM) was established in Rotterdam. Sunlight household soap and Lux toilet soap were marketed in the Netherlands. From 1917 onwards, soap was being made in Vlaardingen.



Originally, green soap was made from hemp oil. This oil has a natural greenish color, so the soap made of it also had a slightly greenish color. Hemp oil was used, because it was a cheap byproduct of the ropewalks. Today green soap is usually made of cheap vegetable oils such as soy bean oil or rape oil. The soap is soft because the oil is saponified with potassium hydroxide instead of sodium hydroxide, such as hard soaps. If you use green soap on paving stones or hard stone, the oil saponifies and then soaks into the stones!

So, if later you again wash the stones with the soap, this will leave another glossy coating of oil!

Because green soap creates not nearly as much pollution in the groundwater than traditional cleaning products, it can be perfectly well used for various cleaning jobs.

This is because it contains no phosphates, which normally stay behind in the groundwater. Green soap is absolutely harmless to the hands or the respiratory tract.
Therefore, the product can be used safely without protection.



Once sand, soap and soda used to be the major Dutch household cleaners. Maybe sand appears in this threesome a stranger.

For us the combination of sand-soap-soda was quite obvious: in the kitchen hung a rack with three jars in it, all made of enameled iron labeled with those three words.

Any Scout who has cooked over a wood fire knows that it is very difficult to clean the pots and pans. Wrapping the pots in aluminum foil helped temporarily, but that often was torn apart. Rubbing with soap was a solution but you could not escape the fact that the pans had to be sanded clean again.



In early days everyone cooked on a wood fire and cooking pots had to be cleaned. For extremely dirty things, like baked pans this cleaning was done with very fine sharp sand.
Many will still remember the coal stove with iron rings, which could be partially removed to let the water-cooker through. They had to be cleaned too...

Today we know that type of sand as yellow sand or river sand. That is a type of sand with big angular grains and it sands very well. You actually still can use it.
Other applications:
* Abrasive Sand was widely used before the war for sanding your hands and to remove fat from the granite counter top.
* Sand was strewn on the floor because of the abrasive action it produces and to bind the dust when it was swept up.
* With sand, the dirt from the wooden shoes was removed and wooden floors were scrubbed with it until they were beautifully white again.
* The cleaning of milk cans and the milk sieve was done with sand.

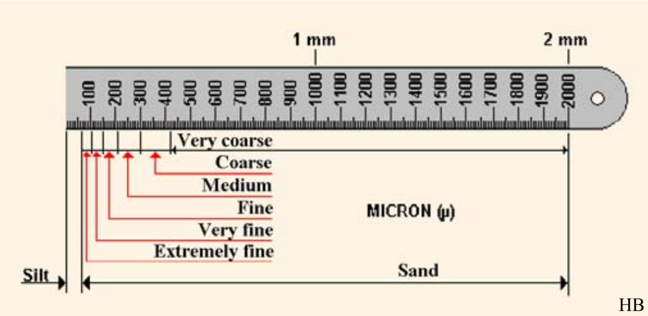
Our grandmothers cleaned everything with sand, soap and soda and our great-grandmothers did this with wood ash and the root of the soapwort (Saponaria officinalis).

Table knives and the carving knife had to be cleaned regularly from rust. This was done with a knife-board and sand was the abrasive. Stainless blades came later.

In this section we focus on grinding and sanding the blades on a wooden board and it appears that some people who are shaving in the old fashioned way with a straight knife, also use a (balsa wood) board with chromium oxide to remove the final burr.

Types of sand

The Netherlands is like one large sandbox: sand can be found everywhere. Despite all that sand that at first glance looks almost the same, there are many differences to explore. Coarse or fine, sharp or not, green, red or colorless. These properties not only tell us how the sand is formed, but also determine for what purposes it can be used. One type of sand is perfect to help build houses, while another is perfectly all right for our toothpaste!



Sand grain diameter	**Wentworth class**
1-2 mm	very coarse sand
½-1 mm	coarse sand
¼-½ mm	medium s reviewand
125-250 µm	fine sand
62.5-125 µm	very fine sand
3.90625-62.5 µm	silt
< 3.90625 µm	clay
< 1 µm	colloids

1 centimeter	= 10 millimeter.
1 millimeter	= 1000 micrometer (µm).
1 micrometer	= 1000 nanometer.

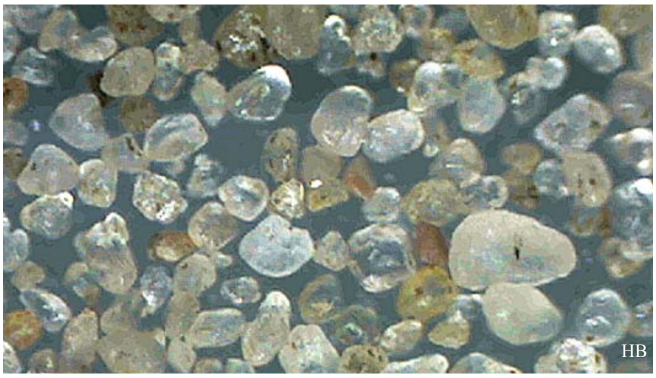
Material smaller than 0.0625 mm is called silt or clay, while grains larger than 2 mm belong into the category of gravel. Everything in between is sand. As a measure you can also use the visibility of the grains, if the individual small grains are visible with the naked eye it is called sand.

The many different names used in the trade make your head spin: concrete sand; milled sand, crushed sand, cope sand, drainage sand, dune sand, glass sand, glauconitic sand, garnet sand, industrial sand, limestone sand, quartz sand, masonry sand, desalinated sand, fill sand, horse paddocks sand, sheet sand, river sand, sharp sand, abrasive sand, play sand, sports sand, street sand, sand dunes sand, Westerschelde sand, sieved sand, sea sand, silver sand and fresh water sand. Really something to google!

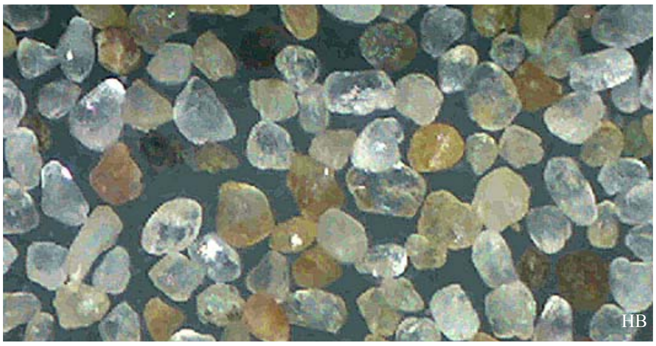
Also you can distinguish with respect to its origin (desert sand and sea sand) and application such as concrete and masonry. On the Internet you can find the strangest explications, such as "sand is grains of sand" and "abrasive sand is used for sanding". Those kind of definitions do not explain anything to us.

As part of this story, we will look for the correct definition of abrasive sand and for what purpose it is used.

Once, every grain of sand started its life as part of bedrock. Rocks that lie on the surface are constantly exposed to weathering and erosion by water and wind.
Weathering and erosion are helped by the expansion and contraction of the rock under the influence of temperature and plants, whose roots can pry the pieces apart. When the pieces of rock get into rivers or the sea, the abrasive action of water, sand and gravel make them degrade further.
The sand particles that are found closest to their origin will have a sharp and angular shape (river sand or sandy fluvial).



This sand from the river Warta in Poland comes from the Carpathian Mountains and forms dunes in the river.
The spots are iron oxide giving it a brown appearance.



Marine sand (beach, Bergen on the Sea, Holland)

Sand that is transported to the sea by a river and has been moved around continuously by its waves, will have a more rounded form (sea sand).

The grains of sand deposited on the beach or along riverbanks may, after they have dried, be taken by the wind.



Aeolian sand from Pape, Latvia.

Sand deposited by the wind is called Aeolian sand. Aeolian sand can be recognized by the fine, well-sorted grains. The grains are small; after all, it is impossible for the wind to carry large grains.

The small grains rub against each other even further, producing an even more rounded shape.

Silica sand - silver sand



Most Dutch sand consists largely of quartz. Does that mean that the original rock is also largely composed of quartz? No, the reason why there is so much in quartz sand is because it is a hard mineral. While during transport, other minerals often are crushed completely, quartz is often the winner and is the only one left. Sand consisting almost entirely of quartz is called quartz sand. This sand is white to yellow in color.

Garnet Sand



Lacquer profile high concentration of garnet in Bergen

There are three locations along the Dutch coast where larger quantities of the mineral garnet are found in the coastal and sea sands: in the South of the isle of Goeree, between Schoorl and Camperduin on the Holland coast and on the isle of Vlieland. Through erosion of the dunes and the beaches there, layers with very high concentrations of garnet occur. This is due to the higher specific gravity of garnet.
Quartz, of which more than 90% of the sand exists has a specific gravity of 2.65, while the gravity of garnet varies from 3.5 to 4.2. Because of this higher gravity, the garnet grains behave differently from quartz grains during transportation. During the erosion of the coast if the water moves at a certain speed, the garnet grains stay behind on the beach, while the lighter quartz grains are carried away towards the sea. In this way layers can occur.
When walking on the beach north of Bergen in North Holland along the foot of the dunes, one can find an area where the sand is strikingly dark red in color as a result of deposits of the mineral garnet.

This high concentration of garnet in Bergen can be explained by the natural selection that is a result of the forces of wind and water when the grains are being transported. In Bergen the garnet grains are concentrated in the area where the beach gives way to the dunes. Garnet sand is interesting for us because of its hardness that will sharpen almost all steels. See also page 7, 8 and 11.

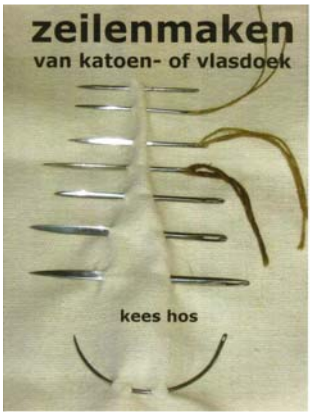
What do tell the sources us about the knife-board



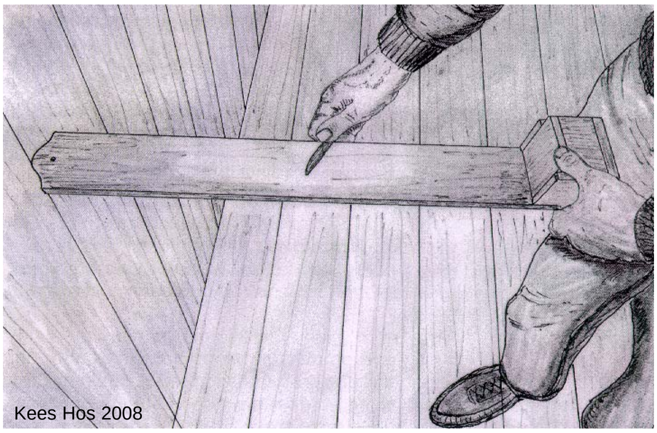
Oak knife-board with sandbox

(See Internet)
1. "In the kitchen, the knives where sharpened on the oak knife-board. The board was 15-cm. wide and 70-cm. long. At the bottom of the board was a box containing silver sand. Some sand was sprinkled on the board on which the knife was whetted. There were people with a dogcart filled with silver sand that they sold door to door."
2. "I used to fetch a bucket of that white sand from the stream for granddad's knife knife-board. A sand box was fitted at the end, and out of that came a bit of fine dry sand when the board was tilted. Granddad honed the knives for the entire family."
http://www.achterhoekeengedicht.nl/Logoud/log1a.htm
3. "One corner was separated from the rest by a wooden board, half a meter high, it was the "stacker" - or "peat corner", where fuels (wood, peat) were stored. The oak, a plank, about 12 cm wide could serve as a seat and was regularly used as a knife-board, sprinkled with ashes from a pile nearby, to keep both the knife used for cutting the bread and clasp-knife sharp.
http://www.hei-heg-hoogeind.dse.nl/historie_gebied/oud_brabants_dorpsleven/brabantse_boerderij/brabantse-boerderij.htm
4. "The knife-board is narrow and elongated and has at the end a bowl in which some small debris from roof tiles (klinki ie dak) or hard clay is kept. To sharpen a knife, the board with some grit or clay on it was held at an angle and the edge of the knife went up and down on over the dust that was sprinkled with water first. After use the board was hung on a nail in the wall".
5. "By rubbing this clay or limestone on the knife-board, a powdery substance is left behind that serves as an abrasive. The knife was sharpened by moving it across the knife-board. The clog-maker calls this: The cutting edge becomes pure".
http://www.lundehund.nl/klompenmaken/ch6.html
6. "Father used sifted ashes from the stove on the knife-board to sharpen the table knives".
http://www.cubra.nl/leedzuinigheid/woordenboek.htm
7. "But white sand was also used, for example, to hone the blades. They used the 'knife-board' for this, after its use it was suspended from a nail in the barn. At the end of the board a container was often nailed to store the sand.
By moving the knife back and forth over the sand sprinkled board, it became razor sharp again".

http://www.plaatsengids.nl/natuur-en-recreatie/ossendrecht/de-pottenbergen
8. "Biksteen" was used to sharpen knives on a special "knife-board", but it was mainly used as an abrasive. It was made of Bentheim sandstone blocks. In those days it was easy to get, because the millstones of peeling-mills were made of sandstone. If one was worn or broken, the young people knew well to deal with it. On Saturday afternoon, after school, the grounded biksteen of that week was sold door to doors. As such it can be compared to modern day newspaper delivery.
http://www.molendatabase.nl/nederland/molen.php?nummer=1213
Knife and knife-board.



A small, sharp jackknife with a narrow tip to unpick the stitching is easiest to use. The apprentice sails maker began his career with the purchase of such a knife. A new blade does not yet cut properly and in order to archive that at that time an oak knife-board with a box of sand attached to it was used. The sand was very fine, and according to tradition came from under the coconut mat at the door. The coarse sand was got stuck in the mat; the dust and fine sand beneath it was suitable for sharpening the knife. Even today, a knife-board is really indispensable because by using such a board the knife gets optimum sharpness.



*Proper use of knife-board: The board should lie horizontally in front of you, with the box facing you and the upper end against the wall. Hold the box tight with your left hand. To be able to apply more force, honing is done at arms length. Most boards are worn on the right, but last year someone from Amstelveen found one at a flea market that apparently was used by a left-handed person.*http://www.quant.nl/zeilnaaien/

Kees Hos remarks: the source is Kees Jeeninga, who started in 1948 in sail-making at his great-uncle, Kees van Kalsbeek in Den Oever.
From: "Zeilen maken van katoen en vlasdoek" by Kees Hos 2008 ISBN/EAN 978-90-813120-1-1

Unfortunately
Gathering information for this story covers a period of approximately 40 years. Unfortunately as a result of this some sources on the Internet have disappeared, so no URL can be given. A URL (Uniform Resource Locator) is a label that refers to an information source like a web page or other file.

Knife-sanding board



The sail-maker of the Zuiderzee Museum sharpens his knife on a knife-board with a sandbox.



This macro shot shows how the abrasive grains have sunk into the surface of the wood.

A knife-board is usually made of oak but ash and elm versions have also been found.
It is important that the used sand is collected to be used again (hence the sandbox). In the process of sharpening, the grains break and become sharp again. This results in addition in an increasingly finer appearance.



A old elm knife-board in the paint grinding mill, the Cat at Zaandam

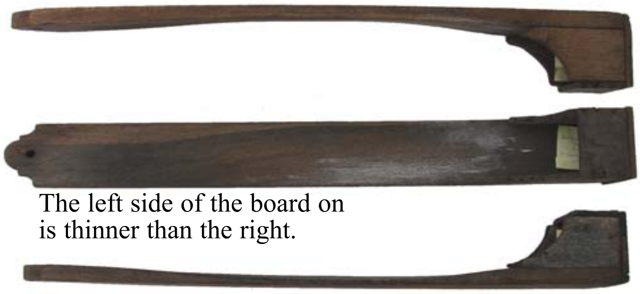
The old original knife-boards show that they are used and therefore become thinner in the middle. The used ones also show that a part of the grains have been pressed in the wood and thus grind instead of "lapping".

See also chapter 2 where "lapping" is explained.

Right and left knife-boards



Knife-boards (grinding marks on door sills too), show whether the owner was left or right handed. Above a right-handed and a left- handed version below.



The left side of the board on
is thinner than the right.

Abrasives used on the knife-board
From stories the following materials emerge as an abrasive used on a knife-board:
* The sand children play with: silver sand.
* Biksteen (ground sandstones).
* Milled brick, tile and pot red.
* Sun-baked clay.
* Sifted ashes from the stove.
* Corundum, emery and smirgel.
* Pigments: bone, iron oxide, chromium oxide.



Shipyard in Oman. Photo: PvB

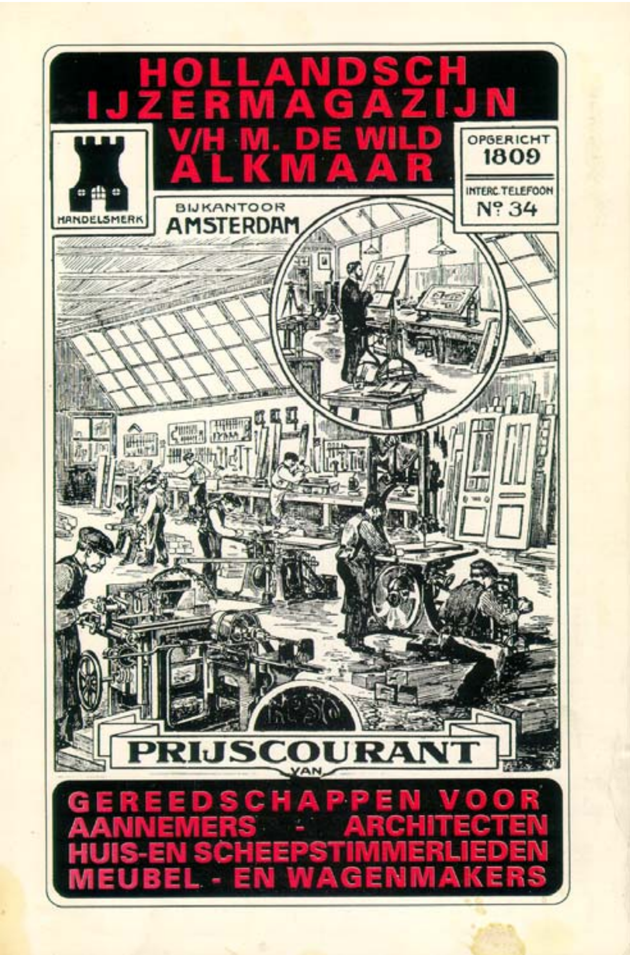
Knife-boards are far from outdated. On the above photo a board is veneered with waterproof sandpaper and used as knife-board in a shipyard in Oman.
The knife-board is currently used as a grinding-paddle for sharpening razors with various pigments such as bone, iron oxide and chromium oxide. As a carrier for the pigment than balsa wood is used.
Take a look at Google "balsa leather" and you'll be amazed.

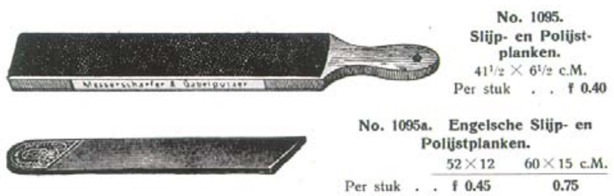
Grinding Tests
Of course I was curious about the results of the various abrasives. To try out a series of test boards was made that makes the grinding tests possible.



Fig. 25a balsa wood knife-board (leather) with chromium oxide Cr3O2, is used to remove the final burr of razors. See also:
http://www.coticule.be/the-cafeteria/topic/251.html

The used boards





The boards are made of flawless ash 380 mm long, 65 mm wide and 10 mm thick. These dimensions are chosen so the boards fit in a casket with the other stuff for the test like the jars of abrasive.
The wood contains pores in which the abrasive gets stuck. For the pigments glued balsa boards are used.





Structure ash test boards



Structure balsa test boards

Knifes to test



Unfortunately, iron knives are not to be found in second hand shops. Because they are rusty, they apparently are thrown away immediately. For test blades 7 "Gero Zilmeta 718" knifes were bought for € 2.80 as they are not jagged and have a large surface.

Sieves

There are beautiful sets to sift sand grains. Not everyone will buy these (they are expensive) and that is why we do the tests with more simple means.
A friendly steel wire weaver provided us with stainless steel samples to make a set of hand sieves.



With some tinkering, aircraft plywood, epoxy glue and drainpipe we have made ourselves a useful sieve set.
The series now runs through 1100, 1000, 800, 300, 200, 150, 125, 100 and 65 microns.
First, the material is sieved with a standard tea strainer with a mesh size of 0, 8 mm. This is similar to grit 20.
The sand grinding experiments we will do with 300µ or finer.



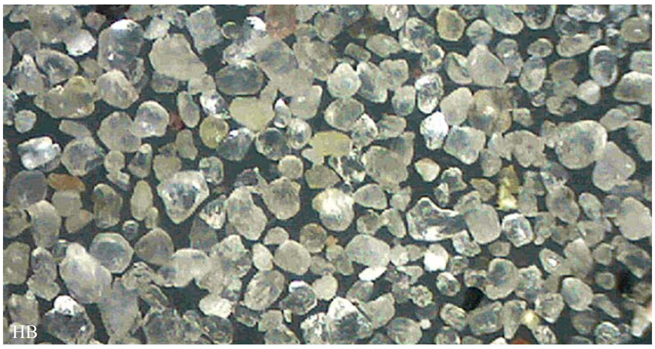
Grain 20



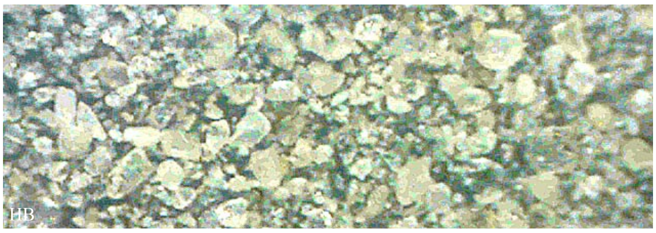
Grain 54

Grinding sample with sand

The special feature of silver sand is that it has already been cleaned, has a fine grain and complies with BS EN1177.
It is square in shape in order to make sand castles, and the grains are smaller than 1.5 mm in order to be gentle on the knees. Quartz sand, silver sand or white sand is a fine-grained, white and clean sand with a very low iron content. It consists almost entirely of quartz (SiO_2). Coarse quartz sand from the quarry can be improved by physical and / or chemical treatment. To make quartz sand suitable as raw material it has to be processed in order to remove the remaining impurities.
In Belgium, silver sand is found in Lommel and Mol and in the Netherlands near Heerlen.



Silver sand at the start of the sharpening test.



Silver sand after the sharpening test. Many grains are broken and have become dirty.



Particles of silver sand stuck in the surface. When the sand is removed the broken grains can be used for polishing with an even finer result.



The grains give a coarse result. By collecting and re-using the sand the result will become finer.

Grinding test with biksteen

2. This stone, is crushed and used in the household as sharpening sand. “De bikstien en schulpzant, moet men hier tegen een halve stuiver het kop betalen, Asselijn, Spilp. 10 [1693]”. The "biksteen" and sharpening sand has to be bought here for two pennies a cup.

2. This stone, is crushed and used in the household as grinding sand. “The bikstien and schulpzant, one has to pay against a halfpenny a cup, Asselijn, Spilp. 10 [1693]”.



A broken sandstone grinding wheel with a prewar Thuringian whetstone on top.

Sellers of sand, Chalc and Bicksteen, Rules of Amsterdam 936 a [1650].
She cleaned her buttocks with biksteen (popular expression indicating an extremely clean woman).

In the book "De uithangteekens, in verband met de geschiedenis en volksleven beschouwd" (The signboards, in relationship to history and and every day life (2 parts)) written by J. van Lennep and J. ter Gouw and published by the Kraay Brothers, Amsterdam in 1868, we read about a sign at a bookseller in Rotterdam:
"The fact that also booksellers had a sign out depicting St. George, as for example Jacob Adriaensz. in the Breestraat in Leiden, is not surprising, because like the pubs the bookstores appropriated all sorts of things, but it seems less clear what he had to do with biksteen and sand. Yet we found this inscription in Rotterdam:
"In the Knight St. George, who conquered the dragon, they sell red and white biksteen and sand".





In the Zaansche Schans we find the Biksteen and Grinding Mill 'The Greyhound'

We will try to attempt to solve the riddle.
***The biksteencellar is where most of the memorial stones come to ruin**. Everything of that nature that is being pulled down goes there to be crushed. Now our Rotterdam man will probably have found a St. George statue among the rubble brought to him, which he considered too good to smash and therefore preferred to adorn his cellar with it, with the rhyme underneath.*

So biksteen originally meant a sandstone. Later it became crushed sandstone being sold door to door.
In the Zaan region many mills stood in the back yard or anywhere else on a piece of land or on a shed and was being run by the young ones.
Biksteen was used to sharpen knives on a knife-board, but was mainly used as an abrasive. The base product was Bentheim sandstone.
This stone was widely available in the Zaan region because the millstones of the hulling mills were made of it. If one was worn or broken, the young boys would grind it into biksteen.

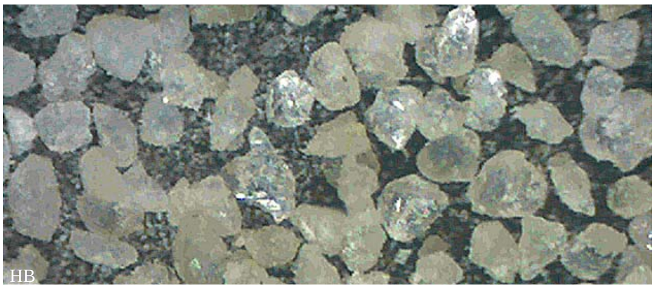
For us it was important to try this out. We visited the Zaanse Schans for a sample of biksteen. Unfortunately, even though the site on the internet said that the biksteen-mill was in operation during the "Molendag", there was nobody around and nobody knew anything...
After intensive mailing and calling we found the miller. Apparently the mill is called "biksteen-mill" but does not produces biksteen! There is not even a sample.

It is well known that if historical monuments like these are to survive they should frequently be operated.
A good example http://www.torenuurwerk.nl/
Idleness rusts, is said and that is why, to preserve the mill and its knowledge, the mill should be put in operation again to make biksteen and certainly on the "Molendag" and other heritage days.

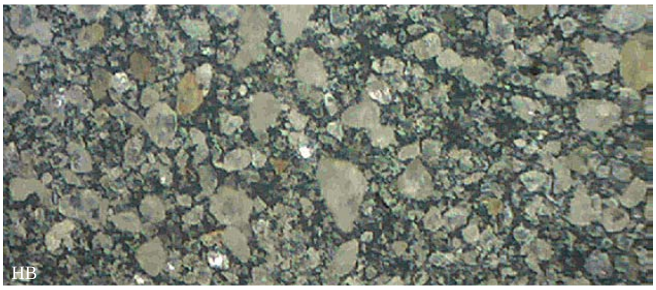
Sandstone remnants are plenty to be found. In the quarry in Gildehausen, sandstone waste is used as landfill and that would be a good material to use in the mill.
Restoration projects also can be a source of material.
It's just a matter of initiative and organization.



We were lucky that on visiting the company Monser in Nordhorn (municipality of Bentheim) we had collected some Gildehausen sandstone samples and we started our own production of biksteen.
http://www.monser.de/firma.htm



Biksteen coarse. The grains are very angular.

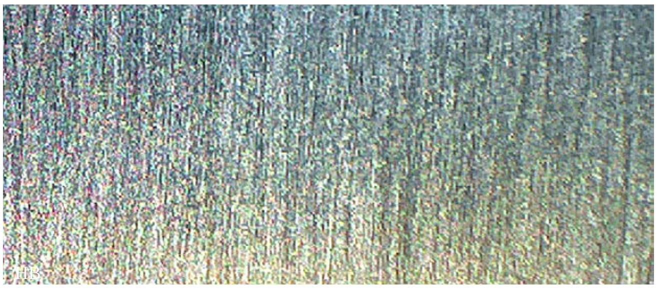


Biksteen fine, particles <54.
With this we will do the honing test.

It will not surprise you that the results are quite similar to those with silver sand.
With silver sand it took a while before the result became visible as it took some time before sufficient grains were broken. With biksteen the result was there straight away and according to the force needed to move the knife on the board it was immediately clear that something was happening.



Very fine particles biksteen are in the pores of the wood.



The still relatively large grains give a rough result.
By reuse of biksteen the result will be finer.



Biksteen after the test..

Brick, tile and clay
Over the centuries the use of bricks in the building process has become self-evident.
The main raw material for the production of brick is clay.
Traditionally the location of clay was the designated place for production of bricks.
Originally the bricks were baked in field-ovens.
These ovens were built on or near the site where the clay was found, or where fuel for the furnaces was readily available. The principle of making bricks has remained unchanged since ancient times.

Brick is as old as our civilization. Baking bricks dates back thousands of years. Clay that hardens in the fire was known already in antiquity. The first finds of ceramic pottery are dating date from 7000 - 6000 BC. Initially limestone was used. The first fired bricks were found in Mesopotamia and dated at date from about 5000 - 4500 BC.

Excavating the raw clay is largely done in the floodplains of major rivers (the Rhine, IJssel, Waal and Meuse).
In addition and to a lesser extent, in the Netherlands sea-clay (e.g. Groningen) and loess or loam (Southern Limburg) is quarried.



White baking clay is extracted from the Westerwald (near Koblenz) and the Eifel in Germany. The excavated clay shows many variations both in mineral composition and grain size. These variations are evened out by systematic and controlled development of the stock of clay.

Clay consists mainly of soil particles smaller than 2 microns; at a rate of 15% or greater it is called clay.
When clay contains a high percentage of small particles it is called heavy clay, clay with a low percentage it is called light clay.
Clay consists of minerals such as illite of clay and smectite.

Clay minerals develop as a result of chemical weathering of rocks. Clay minerals are more or less flat, making them stick together when wet: water works like a glue. This is why clay is so sturdy and well pliable. Between the clay grains there is very little space for the water, that is why clay is poorly permeable. Because of this property clay is used as 'roof' for ground water.

The heavy ceramic industry uses clay to produce bricks and tiles, while in the fine ceramics industry it is used for making pottery. At the beginning of the Holocene clay layers were deposited along the Old Rhine, IJssel and Oude IJssel in Gelderland.

They are decalcified clay depositions or limestone that are still used in the tile industry.



My uncle Henny Bos who was superintendent at brickyard Strating Oude Pekela inspects the bricks.

Dried clay is already pretty solid, but it only becomes a real brick or tile by baking. The baking process will determine the ultimate material properties of the brick. The unbaked bricks will still be yellowish or dull gray in color before they go into the oven. The final color of the brick is the result of the firing process and the minerals the clay contains.

There are several ways to influence the color of the brick:
* by choosing the clay. Ferrous clay bakes red if the containing iron content (Fe_2O_3) exceeds 8% and when this amount also exceeds the lime content (CaO). Calcareous clay (more calcium than iron oxide present) will produce a yellow result;
* by varying the baking temperature. The more purple in color, the higher the temperature has been;
* by adding limestone (marl) to clay that contains iron, a yellow-colored brick can be obtained. But a high Fe_2O_3 content in the clay makes it hard to produce yellow brick;
* by firing with infusion of oxygen. In this process air (oxygen) infusion is used for the complete combustion of the fuel in the oven.

The presence of iron oxide (Fe_2O_3) in the clay turns the products red, other colors may occur when the clay has a other components as well.

Clay-wares in Groningen



Uncle Henny (l) and my father Berend Bos (r) worked at the brickyard where my grandfather Hendrik Bos, after a period as driver of a towing horse, worked as stoker of the ring oven.

The Dutch brick industry mainly processes clay that is deposited along the major rivers (Waal, Meuse, Rhine and IJssel). In addition, there are bricks in Groningen made of recent alluvial marine clay. This is largely decalcified fat clay, suitable for the manufacture of extruded brick masonry. Fluvial clay has a slightly coarser texture than clay deposited by the sea.

In the twelfth century brick production began here in Groningen in the form of "kloostermoppen" (bricks in the shape of tufa as was customary at the time when building the church). First made by monks for building monasteries and churches while the sea water was stopped by the construction of dikes.
The oldest Groningen brick, from the 12th century, can be seen in the churches of Marsum, Oosterwijtwerd and Eenum.
In the early 20th century the province of Groningen had around 80 brickyards. Up until 1990 almost all of them disappeared.
In 2002 there are two factories left: Fimonsteen Hijlkema in Delfzijl and Strating in Oude Pekela. In 2010, the only brickyard north of Arnhem is Strating. They use clay from Winsum and Klein Ulsda, that is kneaded into a sticky mass by adding sand from the Heeresmeer in Pekela. This is as "Gronings" as you can get, a proud Geert Jan tells us during our visit to get a handful of clay (from Winsum) for the grinding test "Sun-baked clay".

Groningen newspaper Wednesday, July 11, 2001
Strating brickyard in Oude Pekela starts on Thursday with quarrying 25,000 tons of clay from the Reitdiepdal in Groningen. This clay, transformed into three million classic red Groningen bricks will return to the same spot, where three hundred luxury homes will be built. People will be living in houses made from their own sub soil.

Own pounding mill

Warning! Use dust mask!



Since we have no biksteen or paint mill at our disposal, we have pounded to powder with particles smaller than 300 microns (K54), a Groningen brick made by Strating and an old Dutch tile from Uitgeest (made from clay with a different origin), using a rod of iron in a saucepan over a 6 cm thick steel plate.
During our visit to the paint mill "De Kat" we found out that, once every two years, 800 kilograms of crushed tiles were milled there to become the pigment "Tile Red" with a grain of 135 microns to serve as a pigment for paint. This pigment we also use to do a grinding test.



Pannenrood (slegt rood) Fe2O3 Tile red (Dutch)
Deze verfstof werd verkregen door het fijnmalen van gebakken rode steen of dakpannen. (Men sprak ook wel van steenrood of boerenrood). Als kleurstof veelal toegepast met water en kalk voor het beschilderen van muren. In de Zaanstreek verfde men er de ‘winterzeilen’ der molens rood mee.

This pigment was obtained by milling red bricks and tiles. (It was alsoknown as brick red or peasant red). As a pigment is was often used with water and chalk to paint walls. In the Zaan region they used it for painting the mill canvas.

Hein Sommer is a member of the Working Group Rigging of the Association LVBHB and spent years going over the question "What are the original colors of our ships."

He has amassed considerable knowledge about paints and pigments. That's why I asked him about Tile Red:

* what grain should the powder have so it can be used as a pigment?
* What was it used for?
* What is the color after application?

The answer

Regarding size, I find no evidence in my literature. Yet this is a very normal question.
Undoubtedly, modern pigments have their established standards; in terms of ancient pigments I cannot find anything about it. However, over the years people become more discriminating. For natural ocher (a mineral) I have found a comment dating from 1940 that it is too coarse for fine painting. They would not have said this in 1880.
The yellow ocher you buy now, is of a very fine grit that used to be reserved for the most expensive ocher only.

I seldom come acros Tile Red. No doubt because it was regarded as inferior. I find this pigment with Simis (1829 and 1835) and with Jacobson (1868). Simis mentions brick red as the worst of all dyes. It is made of soft red brick.
It's only good with tar, because its makes a sandy crust. Jacobson calls it a poor paint in oil, hard to use and most of the time used on walls mixed with calcium and water.

In my painters' books from 1880 to 1940 the pigment is not mentioned. Perhaps beaten bricks sometimes come close to the so-called Red Hull, a beaten British mineral.
The color will probably turn to reddish brown with oil, allthough I have not tried this out, and with lime the color will probably more approach the original material.

The method used in the old days to select the finest grains was the so-called sludgeing: mix the ground powder with water, drain anything that floats and let it dry.
This procedure may be repeated. The water mixture used to run through different bowls, in which ever more fine components were deposited.

If I would make pigment myself I would go for oil paint, to obtain the highest quality. Of course it would be quite nice to try making paint with Tile Red. Probably the drying will take the most time and energy (for heating).

Hein Sommer

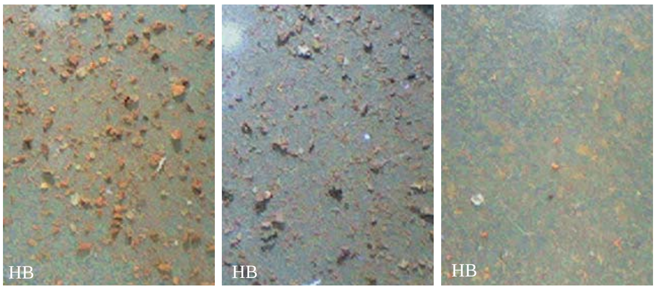


The fact that brick can be used to sharpen a knife, is something we saw happen several times.
The bread knife of my grandfather Hendrik Bos, has been sharpened on these walls quite often, given the marks left behind, and uncle Henny Bos did the same.

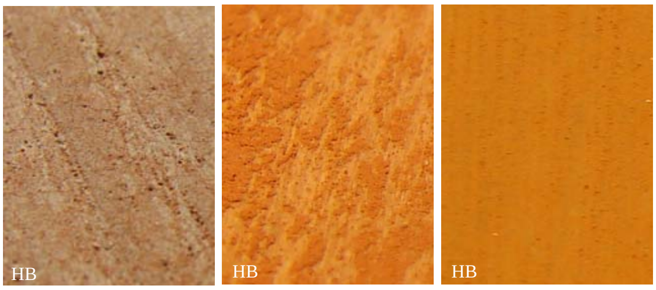


On our trip to Latvia in 2002, we visited in Valmiera the Local History Museum and were shown whetstones made of clay designed especially for practical instruction of schoolchildren.
Indra Vilisterre, director of the depository unit has a deep understanding of culture, is an enthusiastic storyteller and is capable of explaining backgrounds. It became very interesting when we started asking specific questions and were given a sample to take home.

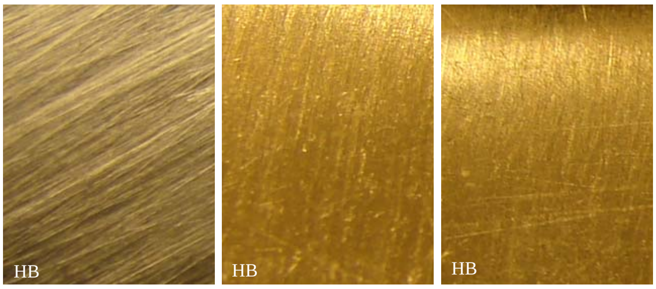
Brick **Tile** **Tile Red**



Before the test



The Wood

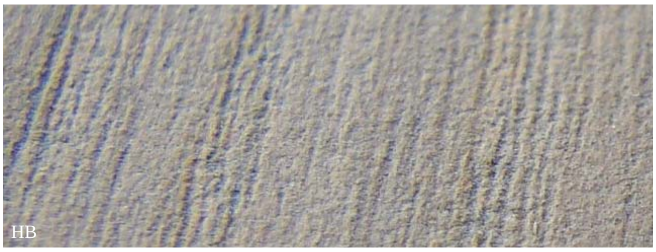


Result

Although there was little difference between pounded brick and pounded tile, pounded brick gives a finer result than silver sand and bikzand.

It removes less material and the appearance is better.
Tile Red gives even a finer result and behaves as a pigment by attaching itself to any material.

Clay





Dried clay clearly has a very fine grain.
It grinds easily and gives a surprisingly good result.
Much better than I had expected.

Other grinding and polishing methods

Pumice



Also called bimsstone. It is undoubtedly one of the oldest abrasives. It consists of solidified lava foam and hence originates from volcanic regions.

It has approximately the same composition as volcanic glass (obsidaan). Because it is ejected liquid it contains a certain grain caused by direction of the flow. In breaking up large pieces, this has to be taken into account. This is the stone the painter used to scrub the paint with and it is so light that it floats on water.



Locations: Lipari Islands (Italy), the Sunda Islands (Indonesia), Japan and Iceland. It is also found in the subsoil of the Eifel in Germany.

The coarse, heavy parts are usually ground to a fine powder that was used for the finer grinding. The silversmith uses pumice to give larger pieces of silverware the first polishing.
To sand down paint you need the middle quality. The hard parts include hard pieces of gravel that are called thorns and in sanding they can cause serious damage. The light species are also not suitable because it breaks down far too easily for sanding. The light types are then combined with the heavy types to be ground into powder.
Pumice was used when the work was suitable "to pumice". This was done in the wet paint to get well-filled pores. When pumicing one rubs across the grain.

Also artificial pumice exists made from diatomaceous earth, pumice powder and clay for the bonding.

Tripoli



This material is found in the vicinity of Tripoli. It is composed of silica and the fossilized animal shells of Radiolarians and Diatoms (siliceous algae).

To get rid of the contamination it is washed. After being fired and ground the final product Tripoli is created.
The raw material is used for various grinding applications. It is also artificially created from a fine-grained mixture of anhydrous silica, quartz crystal and quartz sand. These are all forms of silica. It is also used in polishing paste.

The composition of such a polishing paste is as follows: 1.5 kg silica chalks, infusoric soil 1.0 kg, 2.0 kg of dextrin, 2.0 kg of castor oil, spindle oil 5 kg, 7 kg of camphor oil. This is heated and then dissolved in 30 kg of sulfuric acid of 4-5%.
Infusoric soil is an organic sediment wholly or largely composed of the skeletons of diatoms and unicellular diatoms. Other names for this soil are silica and diatomite soil.

Lime and chalk



The word chalk is an early borrowing from the Latin Calx, genitive calcis (limestone), which in turn is derived from the Greek Khalix (limestone, gravel or crushed stone).

Chalk is the collective name for several minerals (salts) of calcium, such as lime (lime paste, natural chalk), slaked lime (lime, fat lime, air lime, hydrated lime, calcium hydroxide $Ca(OH)_2$), chalk (calcium carbonate, $CaCO_3$), marl and gypsum (calcium sulfate, $CaSO_4$).

This is used amoug other things to make whitewash. Whitewash only has limited covering abilities. The oldest known use of lime paint is dating from the 7th century BC. Then the Greeks already used lime as a base for their paint. The basis for the modern lime paint is still traditionally made in Italy. Lime Paint is a very basic product with an acidity of pH 12.5. Because of the carbonation the pH drops to about 8. Because of these high pH values the product possesses anti-fungal, anti-bactericidal and antiseptic properties. It was applied to walls and stucco ceilings in our home after 1956. If you paint a latex paint over it, it loosens in big slices. There is a primer that penetrates it but it is insufficient when for many years whitewash has been applied.

Chalk itself is also an important part of soft polishing powders. For many people, it is just a chalk stick, with which one can write on a blackboard. This is not quite correct any more. Chalk is indeed so soft that it can be used for writing purposes and this was done for many years. Blackboard chalk nowadays has a different composition, namely calcium sulfate (gypsum) with some additives. Putty is a mixture of linseed oil and chalk powder.

Putty making used to be common knowledge; two parts of uncooked and one part boiled linseed oil was used mixed with 1 part of washed chalk.
The deposit in the oil is also used. A good putty for floors is achieved by adding some wood ash or peat ashes, as this dough obtains an extraordinary hardness in a relatively short time.

Limestone



Vienna lime (or Weener Lime) is a special kind of pure lime, which is entirely free of aluminum, iron and magnesium oxide. Because it is very fine, soft and pure it lends itself well to make cleaning and polishing materials. Is also made by burning dolomite, and will consist of 50 to 100% Calcium magnesium oxide. In instrument making courses we used it to remove grease from the parts that had to be nickel plated by using it as a kind of Vim. Now it is used as a cleaning and polishing agent. Stainless steel (sink, food processors), silver, brass, copper (cooking utensils!) and other metals shine like new. Is also ideal for glass, ceramic plates, stove plates, plastics, garden furniture, porcelain etc.

Vim



Vim was the name of an abrasive powder brand introduced in the UK market in 1904 by Lever Brothers (William and James). The name comes from the word vim, which means pep or energy. The powder, wrapped in a cylindrical cardboard container with sprinkle holes at the top, was a great success and soon it was also sold in other countries.

In 1921 Vim came on the market in the Netherlands, Andy in 1960 (known since 2002 as Cif), Jif came in 1971 and in 2001 was renamed to Cif. At the end of 2004 Unilever as it was now called, sold Vim. Originally, this modern and functional powder also was touted as cleaner for cars and windows. From 1926 on it only was recommended for domestic purposes, particularly when grinding cleaning pans and countertops Vim was used. Vim had a slogan: "Vim produces foam and can not scratch" but because of the silicate used it was not completely scratch-free.

In the liquid abrasive it was replaced by the softer calcite. The hardness is by definition 3.
This development meant that the traditional Vim brand in 2004 disappeared from the European market. In some parts of the world, the liquid medium Cif is still sold under the brand name Vim.

Copper Brush cleaner
is a light polish. Nowadays a common example is Brasso, a product of Reckitt Benckiser, Inc.



Oxygen from the air bound with copper molecules of copper or brass objects produces copper oxides on the surface.
This leaves copper and brass with a brown or black deposit and in time even green. With Brasso you can attack it with a soft flannel cloth by rubbing hard.

Copper Brush cleaner contains oxalic acid that is neutralized by ammonia. The polishing agent is diatomaceous earth with lime.

Polishing copper has the disadvantage that each time a small layer is removed from the object.

The green layer of copper oxides like those you see on copper roofs of church towers e.g. is fairly homogeneous and provides protection against further oxidation (unlike the oxidation - rusting of iron).

If the object has not been polished for some time and you cannot remove the oxides, you better tackle it with a canvas disk and polishing paste (available at good hardware store). Copper cleaner is also excellent to make an object made of zinc presentable again.

Tinder or punk



(Polyporus [Fomes] fomentarius). Echter (real) Zunderschwamm, Amadouvier, Hoof Fungus or Tinder Bracket. The Latin and Dutch names already indicates what the fungus was used for. Fomes is a material to make fire, which we also find in fomentarius. Tinder or punk, Tinder Bracket (English) and Zunderschwamm (German) and Amadouvier (French) refer to the historical use as a lighter.

The woody structure of dried punk is well suited to remove the last burr of a razor in a similar way as the barber used to do with a leather belt.

The false tinder or birch fungus (Piptoporus Betulinus) was also used for this purpose. For whetting the flesh was cut into long strips and dried. In dried form it is very hard to cut.



The dried punk can become so hard that the coppersmith uses it to sharpen his tools.
Both the punk and the birch fungus are ideal for use as a wick for a lamp or to make excellent fire starters when soaked in animal grease.





If you look closely you can see near the kitchen door of an old house often that the brick wall next to it has a smoother surface at hip height than the rest of the facade. This one was found in Hierden at Harderwijk.

Pavement - sill - granite countertop
In order to sharpen knives and such, a grinding stone is often used. But just for honing, that is too much trouble. It is much easier when cooking to open the door and strike the knife along the wall or the pavement.
This was common. Every time I ask a question about this it is confirmed. Unfortunately, through renovation and / or restoration many of these tracks get lost.
In churches it can be seen clearly that damaged bricks have been replaced. A piece of culture is lost in the process. When a house is sold, the grinding marks are not understood as such and the stone is replaced. Then it looks better to the new residents and they are unaware that the soul of the building is damaged.

Quote from Wasps by Jan Wolkers



These kinds of granite countertops also called terrazzo were often used to sharpen a kitchen knife.
Unfortunately I have no picture of a specimen damaged by honing.

“He got up, grabbed the bottle of vinegar from me and put it back in the cupboard. Then he shook the fish out off the keep-net and took the potato knife from the drawer. As he bent over I carefully took the tangle from his back and walked into the room where I put it into a fold of the curtain. Then I walked to the window and looked out. The sun shone with coloured beams of light through the trees. Across the yard grass tussocks were brightly lit, separate, soulless. In the kitchen I heard my father sharpening the knife on the edge of the counter top. I quickly ran to the radio and turned it on. But before I it warmed up I heard the cracking sound and the scratching on the shelf when the fins were cut off.”

Ceramics





During wartime and shortly thereafter, animals were still slaughtered at my grandfathers home and afterwards there was a big dinner-party. It was about this time when I saw my uncle Bauwe turn his plate in order to run his knife along the unglazed rim. Later I realized that it was not such a bad idea to do so.
The correct angle when sharpening knives is important. This should be about 15 degrees, when using separate grinding and sharpening stones. During the sharpening process the blade has to pass the stone in such a way a as if cutting a thin layer. This is done in one movement from the handle to the tip of the knife. Mol: "The less pressure you exercise, the sharper the knife will get." Speed is not important when sharpening. It is important that both sides of the blade are evenly run over the sharpening surface.





Several companies have made ceramic "honing steels", one of them Meissner. The (Arkansas) Washita Stone has a porosity of 16%, which corresponds to unglazed porcelain.




Home > Knife Sharpeners > Aluminum Oxide & Ceramic Sharpeners > Superstick Ceramic Sharpening Stick

Superstick Ceramic Sharpening Stick

Item# ao4
$4.99

Availability: Usually ships in 2-3 business days.

Add to cart

Product Description
1" diameter ceramic sharpening rod. Wood handle. 16" overall length.

The ceramic "honing steels" are still available but in Europe they are 10 to 20 times as expensive as in America. In contrast with sharpening steels the ceramic version sharpens and takes away material.



Kwast Company in Den Bosch

Corundum - Emery - Smirgel

Corundum
The crystals are hexagonal and usually bounded by many sloping surfaces. The hardness is 9 (1650-1850 Knoop) with a specific gravity of 3.9 - 4.1 kg/dm3. The hardness of corundum is close to that of silicon carbide.
The crystal structure is such that in use always new angles and cutting edges appear on the surface.
The color usually is grey or reddish. Sites are in India, Canada and South Africa.
Natural corundum is used as loose abrasive in the optical industry.
A variety of corundum is ruby. Due to its hardness corundum not suitable for jewellery is used for grinding and polishing.

Emery
These aggregates consist of dense granular corundum mixed with magnetite and therefore dark in colour.
The hardness ranges from 7.0 to 9.0 on the Mohs scale.
The the only natural stone that is harder is diamond. In the Urals blue corundum crystals with a content of 35-40% are found. In Burma and Sri Lanka (formerly Ceylon) it forms the rare sapphire and ruby.

Note: Magnetite, Fe_3O_4, is rich in iron ore and as such found in the Kiruna district of Sweden. The name points to the strong magnetic properties, which already were known to the ancient Greeks. The octahedral or rhombic crystals are black with metallic luster, and as indeed all members of the spinelgroup has no split directions, the gravity of 5.17 is also the highest of all the spinels and the hardness is 6.
Magnetite may contain a little titanium, chromium or manganese.

Smirgel
(German for Emery.) This is a grey to black material, consisting of about 65% alumina and mixed with magnetite, quartz and iron gloss. Depending on the purity the hardness varies between 6 and 8.

Note: Iron gloss is a literal translation of Eisenglanz.
This is an old obsolete name from the former mining of hematite (Fe_2O_3).

Naxos
The island of Naxos (ex Cyprus) provides a fine-grained, dark brown to almost black rock of great hardness and toughness. It is found in layers of 5 to 10 meters thick.
The main component is aluminum oxide (45%).
The specific gravity ranges from 3.64 to 4.07 g/dm3.





On the emery stone at the paint-mill "De Kat":
This is a very hard rock from the Greek island of Naxos. This was not used as a dye but for grinding and polishing purposes.
Emery was not ground but hammered with heavy pestles and then sorted to size on a harp (shaker sieve).
The German cities Remscheid and Solingen were the largest customers. It was here that knives, scissors and mill saws were whetted.



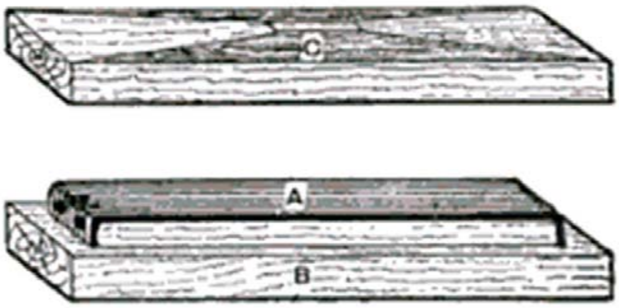


The Zinndorf company of Ransbach-Baumbach used Naxos Smirgel as raw material for the so-called shoemaker's stone. These cigar-shaped stones are frequently (2010) found in the flea market in Beverwijk. Unfortunately I have never seen the matching wooden handles. With a handle glued on it is used in the same way as a sharpening steel.

Levantiner (Turkish stone).
Found in Crete. This is natural Emery in a softer and less pure form than the Naxos. This is or has been used for cleaning printing rollers. The Wilz Company in Idar Oberstein (Germany) still supplies it.

Emery
In America even softer Emery is found. Because of the mild abrasive properties it is used on sandpaper for sanding wood. The smooth shape of the abrasive grains obtains a good result.

Whetstone substitute
In the book "Wood Working a book of Tools, Materials, and Processes for the Handyman", by Paul Nooncree Hasluck we found the following description on page 128.

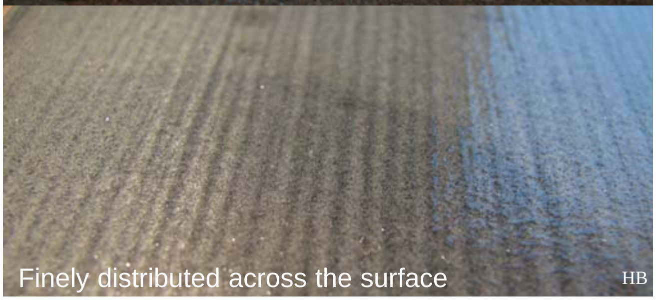


"*A very good substitute for an oilstone is to be made very cheaply with zinc and emery. Get a piece of zinc about 8 in by 2,5 in, and tack it at the corners to a flat piece of wood; then use a little flour emery and oil, and rub the tool on it as usual. Fig. 450 shows a cheap and efficient form of carpenter's hone, which is a excellent substitute for the oilstone. It consist of a strip of sheet zinc A, stretched over the wooden mount B, and screwed down at each end lengthways of the grain. To use the sharpener thus made it is necessary to sprinkle a little flour emery on the zinc and moisten in the usual way with oil. For general purposes will be found very handy, and will do the same work as the oilstone does in less time, but it will not leave the edge in quite such a finished condition as does a good oilstone. C shows a cover for the stone.*"



We had to try out this method.
A cut off of ash was cut in the form of the test-paddles and a piece of zinc put on top.
The result is very surprising. It provides a frotted surface. Clearly an example of the operation called 'lapping'.
The Emery grains roll over the zinc and occasionally tap a small part from the material. This contrasts with the grinding operation that causes grooves.
After that a chisel was sharpened and I also got surprisingly sharp results, with a long service life.

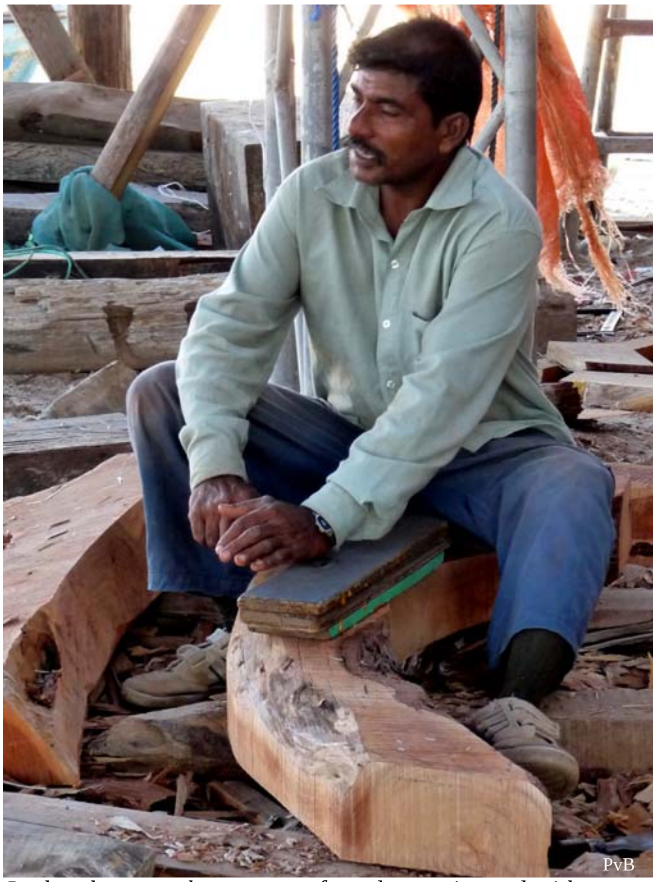




Finely distributed across the surface



Surface of a ground knife



In the photograph waterproof sandpaper is used with water. Because of the glue a long service life is obtained.



Alternatively, abrasive valve grinding paste can be used

Wood ash



In the years I went to technical school to learn a trade it was necessary to clean and lite the stove in the morning before pancakes could be made and we could go to school.

With the ashes you could do some interesting things, like keeping the path passable during snowfall, but also in the house there were applications like sanding and cleaning. Sifted ashes were used for sharpening knives on the knife-boards.
See: http://www.cubra.nl/leedzuinigheid/woordenboek.htm

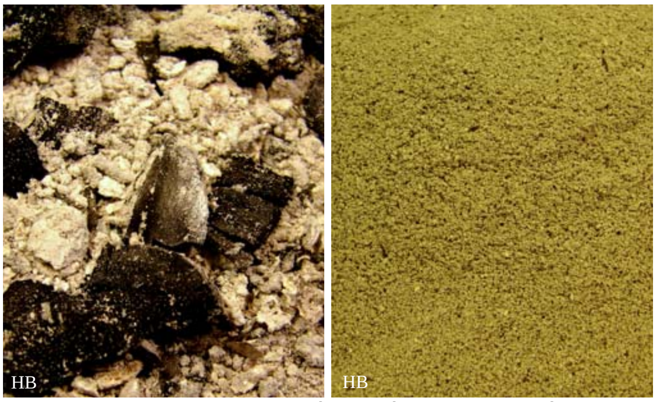
Wood ash could be used as a detergent especially the pure wood ash, and preferably not from wood that grows on the waterfront because there is not much usable potash in it.

The ashes you put in an old pillowcase and you pour water over it. The result you get is called lye and contains caustic potash. This is also called calcium carbonate and has significantly increased pH value. Do not put your hand into the lye because it burns the skin. This liquid can be used for washing linen.

Interesting is the use of potash in the glass industry.
Glass is made of cleaned silver sand and potash as a flux.
If the potash comes from forested areas the glass is greenish through the use of potash. In the coastal areas (e.g. Venice) by using of soda the glass is colourless.
Natron is sodium hydrogen carbonate (sodium bicarbonate) and natron carbonate (soda) like it is found concentrated at the edges of the salt lakes in Egypt.

In enamelling potash is used as a flux. In early days there was a man who bought wood ashes to make potash that was potted and send. Potash was used for many things, e.g. as a substance of making soap.
That is why buyers of ashes usually where also soap-boilers. Enamelled pottery that became black inside is boiled with soap water en kept shiny by rubbing with some wetted wood ash.

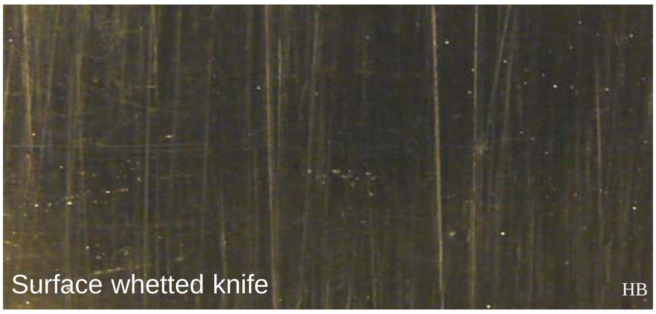
Grinding test with wood ash



Ashes and charcoal collected from a fireplace and sifted K 54.

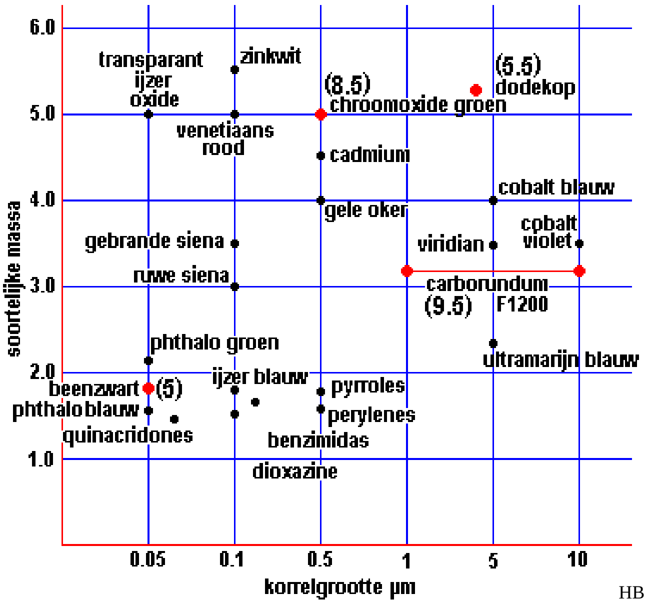






It is not possible to use dry wood ashes because even by beating normally it flies off. With some moisture however it can be used. The small particles of silicon in the ashes have little effect on the steel. Clay performs much better with a far better result.

Sharpening pigments



The red dots are the useful pigments with which the last finish to an edge can be realized. The numbers between () indicate the hardness in terms of the Mohs scale.

When grinding a tool a burr is created on the cutting edge. A blunt knife is no longer tapered but is more or less rounded. When this is then sharpened on both sides the edge becomes sharper and thinner making it easier to be bent. When the cut edge has reached a thickness of some micrometers it tends to bends away from the stone - then a burr is created. The burr can easily bend further and so, for a perfect cut, will have to be removed. If it bends all the way through, the edge is blunt again.
The burr can be removed with polishing paste on a leather strap. This is the method that used to be practiced by the barber for his razor. Polishing paste contains particles that are harder than the material of the tool.
The small particles will become embedded somewhat in the leather while a small part sticks out. When a sharp knife edge is pulled over the belt with polishing compound the burr will be removed. For leather, we use the outside of the skin. There are long discussions about what type of leather should be used. The harder the leather the less deep the abrasive particles nest in the leather. By using less pressure, the cutting edge will stay sharper.
In soft leather, this will become more rounded. Nowadays balsa wood is used as an alternative that also achieves a relatively flat cutting edge.

Polishing Pastes

These pastes are supplied in a wide variety in the form of blocks or bars. The paste is designed for use on buffing wheels of linen, cotton or felt.

The consistency of the paste is quite hard because when applying to a rotating disc a lot of frictional heat is developed. For use on leather belts it is less suitable as they will crumble and as a result the material does not nest in the pores of the leather.

Also on offer is an unctuous polishing paste that comes in tubes or syringes. The most appropriate are the Dovo polishing pastes. They are smoother and specially made for use on a strop.

Pigments



In the pigments room of the paint mill "De Kat" on the Zaanse Schans several abrasive pigments are present and available. Some examples are: Tile Red, Colcothar, Emery, Pumice Powder, Triple, Lime of Vienna, Chalc and Bone.

There are many pigments that can be used to grind or polish. These pigments in powdery form are available in various particle sizes and hardness. By mixing with oil you can make your own polishing paste, needed are approximately 15 volumes of oil to 85 volumes of pigment. As a result of the fineness of the grains is not possible to apply this in dry form. The dust will just fly away.
Many enthusiasts use baby oil as a bond.
This also gives good results over time and therefore the fans of the wet razor often use it.
Google: balsa oil strop. In this story we will test four pigments and two alternatives on a balsa surface namely: Bone, Colcothar, Carborundum, Chromium Oxide, Boron Oxide and Coticule Flour.

Bone Black



Also called burned sheep bones and burned stag horn. These are some of the finest polishes. The bones or horns are burned with only a little oxygen and the leftover ash is used as an abrasive or pigment and consists largely of phosphoric calcium.
Phosphoric calcium is also found in nature and is then called apatite. Apatite is a mineral, or rather the name of a mineral group, because the composition of apatite may vary. In nature, for example it is found on the Kola Peninsula near the White Sea.

Apatite can be white to grey, green, blue, violet or pink. It is a translucent, sometimes fluorescent stone with a glassy to semi-resinous luster. Apatite comes from the Greek word apatan = cheat, because the stone occurs in so many colour variations that it can be easily confused with stones like Beryl, Topaz and Tourmaline.
The human skeleton consists largely of phosphoric calcium. The hard outer layer of teeth also consists of apatite and has a hardness of 5 on the Mohs scale. Nettle also contains a large amount of phosphoric calcium.

Colcothar

Colcothar can be used as a paint pigment as well as for grinding and polishing. Contrary to what the name suggests, colcathar is non-toxic.



Colcothar is a red and purple dye, almost entirely consisting of iron oxide (Fe_2O_3) and clay soil. It is an artificial mineral pigment. It is extracted from weathered iron ore rock or clay by a process of washing and grinding. Colcothar contains about 87% iron oxide and only 10% English Red. These pigments have been used since the ice age.
It does not fade and is therefore very suitable as a dye. The colour is a beautiful deep red to purple. Colcothar purple is light resistant, has good colouring and covering characteristics and is suitable for oil, casein, glue and chalk paint. Casein is an adhesive and a binder bond for paints, and is prepared by heating skimmed milk and adding hydrochloric acid. Casein is also called cheese dust.

Colcothar contains acidic components that promote rust. Apart from the use in paint colcothar was also used for coating buildings to get the dark red colour in cement mortar. Pigments for colouring cement or concrete must be resistant to alkalis and to the influences of weather and wind to which they are constantly exposed.

They have to have a maximum colour strength. Iron oxide pigments meet these requirements and are in fact the most commonly used pigments for colouring cement mortar.

Because of its uniform hard grain it is much used as polishing agent. To polish you can mix it with fat (tallow) or with water, then it can be applied on a balsa wood board.

The most common polishes are Red Polish and putty powder. From about 1940 Red polish or "Paris" Red, grain size 0.003 to 0.006 mm, has been replaced by ceriumoxide and thorium oxide, grain size 0.002 mm. Putty powder is tin oxide, it is a polish for soft glass.

Different opinions can be found about Colcothar.
We have listed a few:

* The red earth pigments were called in Classical Antiquity "rubrica" or "sinopsis". Red bolus is mainly used as a base for gilding.
* Colcothar is also called Spanish Red.
* Colcothar was already known in antiquity as "mortuum paput" (head = Paput, mortuum = death) because it was traded in round balls that, also because of their colour, were reminiscent of skulls.
* Ox Blood, also called colcothar or mortuum paput, is a dark red pigment widely used in historic buildings, especially on wood.
* Almost all the red tiles, red bicycle paths and red brick is red because of the colcothar (iron oxide) in it.
* Colcothar exists in more versions, e.g. the red colcothar or Spanish Red (from Malaga, Spain) and the purple colcothar, a waste product from the iron ore industry (contains more iron oxide).

Carborundum

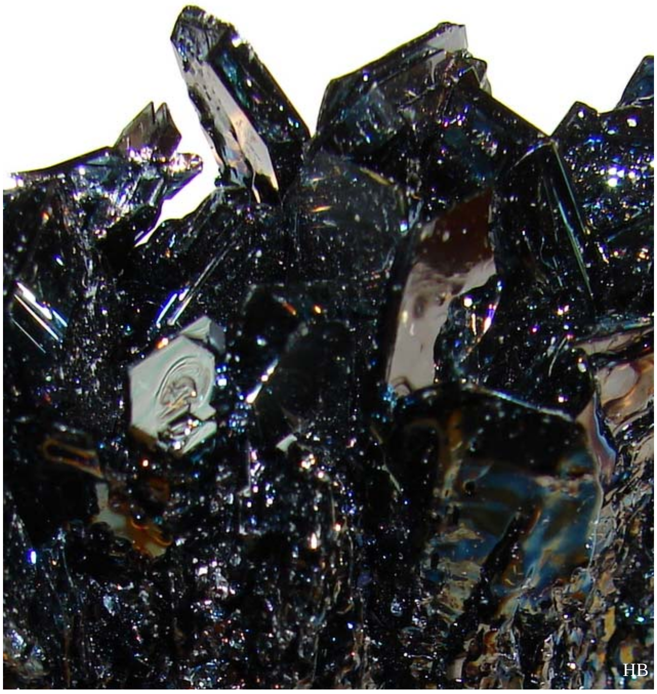
Silicon carbide (SiC; trademark Carborundum ®) is a very hard material with a crystalline structure identical to that of diamond. It is made of SiO_2 (quartz sand) and carbon in an electric furnace.

The crystalline form of silicon carbide occurs when carbon with silica is heated to a very high temperature (> 2000 °C). In this process the silica is reduced to silicon, which bonds with the excess carbon.



After cooling a beautiful green crystal emerges that by then has completely lost the properties of the various substances.

This process is not expensive and is therefore widely used. It occurs in the varieties green, black and grey.



SiC is used for grinding and polishing, in the form of grinding wheels, polishing and abrasive powders and as coating of sandpaper. It is produced industrially by Kollo Silicon Carbide in Delfzijl. The density is 3.22 g / cm ³. The hardness = 9.5 on the Mohs scale (diamond 10) and it is resistant to high temperatures, acids and bases. If it is broken down sharp points emerge again.

It also occurs in nature as the extremely rare mineral moissanite. Henri Moissan discovered the mineral moissanite, while studying the mineral samples from a meteor crater located in Canyon Diablo, Arizona, in 1893. Because of the crystal structure he first thought wrongly that is was diamond, but in 1904 he has identified the crystals as silicon carbide. The mineral silicon carbide was named moissanite in honor of the work of Moissan.


HOLLANDSCH IJZERMAGAZIJN v/h M. DE WILD — ALKMAAR. 177

No. 1095. Slijp- en Polijst-planken. 41½ × 6½ c.M. Per stuk . . f 0.40

No. 1095a. Engelsche Slijp- en Polijstplanken.

	52 × 12	60 × 15 c.M.
Per stuk . .	f 0.45	0.75

No. 1095b. Amarilpoeder in bussen van ± ½ Kilo per bus . . . . f 0.35

Amarilpoeder in diverse korrels en kwaliteit voor het slijpen en polijsten, verpakt in fusten.

Zie pagina 191 van deze Prijscourant.

HB





Chromium oxide (Cr_2O_3), has the structure of aluminum oxide, and consists of a hexagonally packed array of oxide anions with 2 / 3 of the octahedral holes covered by chromium. Similar to aluminum oxide, chromium oxide is a hard and brittle material (Mohs hardness 8-8.5). It is brown when heated but returns to its dark green colour when cooled. It is hygroscopic.

Green chromium oxide pigment has a concentration greater than 98% chromium oxide and a low Cr^{6+} content. Chrome oxide green with low Cr^{6+} content is not toxic. Like all oxides, chromium oxide green is highly stable pigment and UV resistant and therefore the most important green pigment. Because chromium oxide green has a good covering power, it is frequently used in paint products.

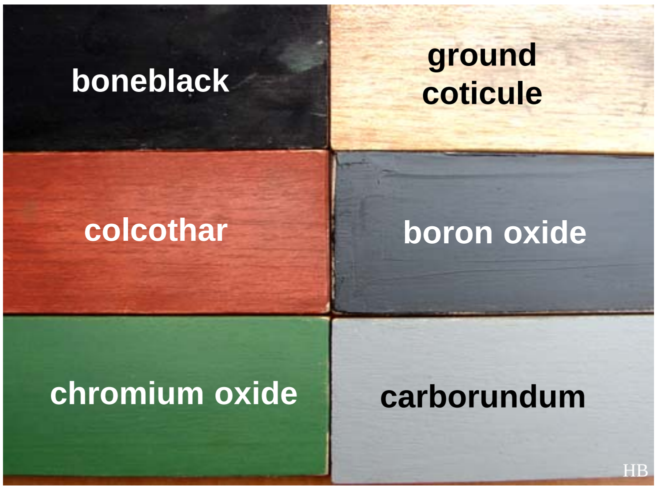


Dovo strop paste
* *Colourless on the back of shaving straps*
* *Yellow = grease for leather*
* *Red = colcothar*
* *Green = chromium oxide*

Chrome green can be purchased only in 'olive' green colour. Louis-Nicholas Vauquelin discovered Chromium in 1797, while experimenting with a material known as Siberian red lead, the mineral crocoite ($PbCrO_4$). He produced chromium trioxide (CrO_3) by mixing crocoite with hydrochloric acid (HCl).

Although he thought there was no way to isolate chromium, Vauquelin in 1798 was pleasantly surprised by the discovery that he could obtain metallic chromium by simply heating chromium oxide in a wood fired oven. Currently chrome is extracted by heating the mineral chromite ($FeCr_2O_4$) together with aluminum or silicon.

Tests with pigment



From leftover ash in the workshop we made 6 paddles. The company "Fijnhout" in Amsterdam supplied balsa strips of 5 mm thick and 65 mm wide. These were cut and glued with epoxy on the paddles. The glue must be applied in a thin coat since balsa is rather porous and I do not want hard spots in the balsa surfaces. After sanding the paddles were varnished as pigment combined with oil behaves in a similar fashion as paint. By sealing the ash surface with varnish the paddles can easily be wiped clean.
After gluing it makes sense to level out the surface of the balsa. This is best done with a glass plate as a substrate to support a sheet of K360 waterproof sandpaper.

Application
There are three ways to do this.

* Rubbing in with a finger. Wear gloves. When you have a small wound you may find you have a tattoo.
This method only works if there are no drafts and the breath can be held for a longer period. The fine grain can be blown away easily.
* Make a paste. A little bit of pigment is applied. In the middle a small hole is made in which baby oil is dripped. In the manner of making cement a paste is made. The paste can be distributed with a finger, but it proved easier to do this with a trowel.
* Spraying with a perfume bottle. Put 1 / 3 pigment and 2 / 3 alcohol in the bottle. After shaking the pigment can be applied as a spray.

See:
http://japaneseknifesharpening.blogspot.com/2010/02/applying-chromium-oxide-to-felt-pads.html
Wipe off the excess with a paper towel.

Testing



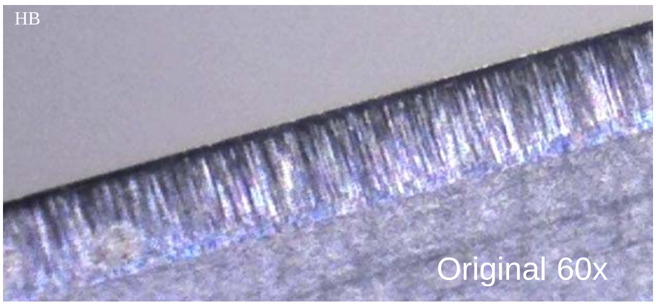
I am too careful with my old 'straight' razors to do all kinds of grinding tests. I have therefore choosen an alternative.

We went to the Turkish market in Beverwijk and purchased 2 "USTURA" razor holders with 15 standard stainless steel double-edge Gillette safety razor blades (4.5 cm) for 10 Euros. Gillette Goal blades are made among others by Gillette in India.



This allowed us to do 30 grinding tests.
Dovo has the Shavette razor holder for removable razor blades on offer but this will cost € 26.60.

The razor blade is too big for the holder. It must first be broken. This can be done best with a pair of pliers and some caution. After breaking a razor blade, it fits the Ustura holder.



We looked through the microscope to see how the edge looks magnified 60 x. We see traces of grinding that disappear near the cutting edge. How they do it I do not know but the cutting edge looks as if it was run along a sharpening steel or something similar.

We did a sharpening test to see if the pigments can improve on this.

Soon it was clear that the razor holders are useless to run the blades with the cutting edge over a paddle. The desired angle of 10 degrees cannot be obtained as at this angle the blade does not touch the paddle.



After some experimenting, we came upon another solution using a scraper designed to remove paint from a window.



In this the blade stretches out further and the blade holder can be taken off. This piece is ground off underneath to produce a 10 degree sharpening angle. The blades are 0.1 mm thick and the cut is 0.3 mm long...

Who wants to know more about sharpening a razor can turn to the excellent work of Professor Emeritus John D. Verhoeven, Department of Materials, etc.
http://www.bushcraftuk.com/downloads/pdf/knifeshexps.pdf

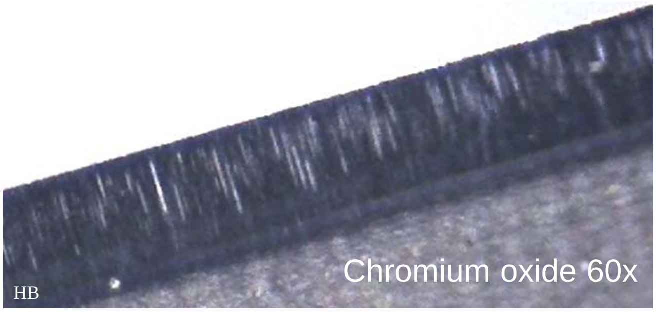
It appears that with careful sharpening and stropping (on a belt or balsa) gets a result that is almost equivalent to a Gillette razor fresh from the factory: a width of the cutting edge of 0.3 to 0.5 microns.

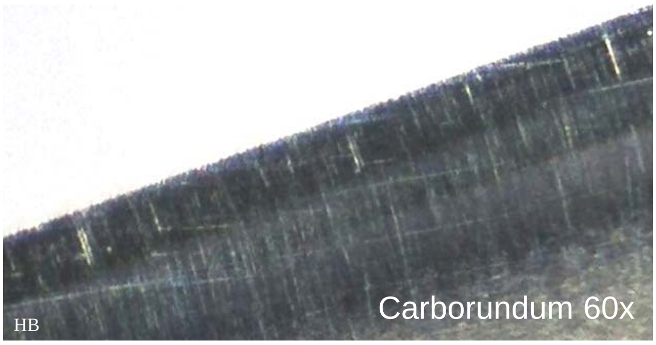
Better cannot be achieved, even with a good quality steel. It is important to hone on the stone with the edge in front, at a constant angle. Stropping however has to be done away from the cut. Stropping on rough leather without polishing paste actually has no effect, and if you push too hard you can make the edge easily worse because it will bend.

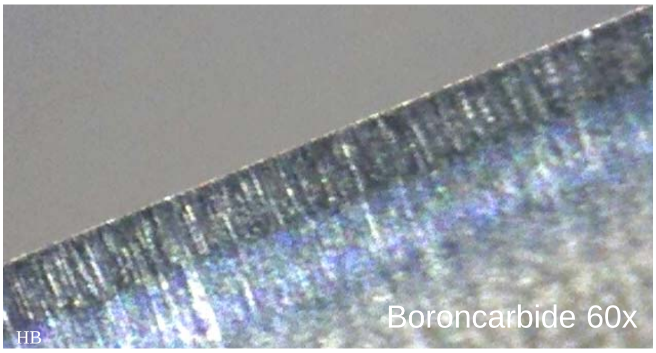
Grinding Test with pigments











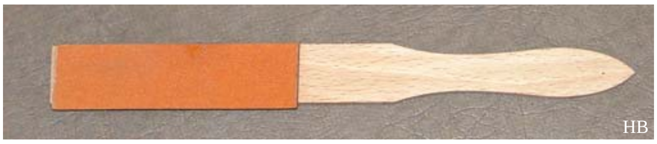
Bone Black generates moderate sharpening action so it will take a long time before there are visible results.
Colcothar (red) has a moderate effect but gives a good result because of its' grinding granules. For fine work it is my favourite.
Chromium oxide (green) has a stronger sharpening effect than colcothar.
Carborundum has a strong sharpening effect. Because of the sharper grains it is more aggressive. Is good for razors although many prefer colcothar and chromium oxide. Wiping with a cloth caused the slanting scratches.
Boron Carbide (lappingpaste) also has a strong sharpening action. Because of the greasiness of the paste it is more difficult to use but the result is the same as carborundum.

The results with Dovo pastes approximately correspond to our grinding experiments. See:
http://winkelplein.nu/barbershopsuply/default.asp?sid=lx2bsevh7QVjS6MOYSWyT2jLdFzr0F&page=detail&Id=601731

Supplement abrasives



In the years 1958-1961 I trained as an instrument maker. Here we used a wooden abrasive file with very fine waterproof sandpaper glued on. The file was made from a piece of teak with a turned round handle. As a glue we used heated colofonium resin.
(Colofonium resin is produced from sawdust of spruce, pines, conifers, and is used as resin for the bow, paper, printing ink, linoleum, coping wax, cosmetics [wax, eye makeup] adhesive plaster, soldering flux paste, glue, scrubbing -, floor - and car wax, varnish, to make the skin of athletes rough and in dentistry.)
With the sharpening file and freshly-glued sandpaper it was possible to archive a very beautiful surface to the work piece. Then it still was a intensively practiced skill to file to a purely flat surface which yielded a very good hand strength in the process.



Another skill was making technical drawings where a knife-board was used to give the pencil a nice sharp point and to make a nice bevel on the pencil lead of the compass. It was the era that we had no Red Ring Pens and pencils, but we were using a poplar drawing board and beech drawing hook.

For this story quite a lot of abrasive -, grinding - and polishing materials were collected. Interesting things can be done with them like:

* Levelling of a much used whetstone. This can be done by spreading abrasives mixed with water on a flat (mirror) glass plate. By moving the stone over the plate in a circular motion, you only hit the tops. It is useful to make some pencil marks in advance so you can see where material is being removed.
* Another application may be: making your own hone by binding the abrasive grains with epoxy.
In the artificial stones, a fine clay is mixed with the abrasive grains after which it is baked. The temperature determines the softness of the stone.

Naniwa



Dimensions: 210 x 70 x 20 mm
Grit: 10000.
Resin Bound
Abrasive: White aluminum Oxide.

On the Internet information can be found about a homemade epoxy bonded whetstone.
Google on "Home-made sharpening stones"
http://knifeforums.com/forums/showtopic.php?tid/829052/post/new/
That it is not so strange shows the fact that there are also plastic-bonded sharpening stones on the market.
The advantage is that the stone does not absorb water.
Google for: Naniwa Super Waterstone # 10000.

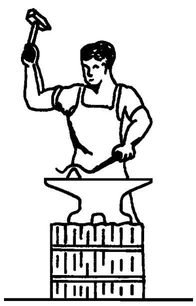
Summary
Some of the sharpening methods mentioned are rather crude and can inflict lasting damage on good kitchen knives and chef's knives! With the rough methods you will get an uneven texture with torn pieces of metal so the life of the blade decreases.
The finer methods can give you a good edge you can shave.
In the time that these methods were used there was nothing else.

The materials listed from coarse to fine:
* **Most extreme rough**: knife-board with sand or bikzand, brick wall.
* **Very rough**: knife-board with tile or brick, pavement.
* **Moderate Coarse**: knife-board with Tile Red, granite countertops.
* **Moderate Fine**: knife-board with sun-dried clay, or ceramic plate edge; "ceramic sharpening steel" depending on the grain.
* **Very Fine**: Colcothar, chromium oxide, bone, newspaper and punk.

Note
For grinding, honing and polishing tools, visit the website of Brent Beach:
http://www3.telus.net/BrentBeach/Sharpen/3m.html
This is so good that there is little to improve.
It shows all the tricks and facts on sharpening tools.

Additions and improvements are very welcome!

Part 2
This story is larger than expected. That's why we stop here.
There is much more to say about natural European whetstones. This we will do in part 2 what will be compiled during the coming year. We will make some "field trips" to refine our knowledge a little more and probably to expand our collection of over 300 whetstones...

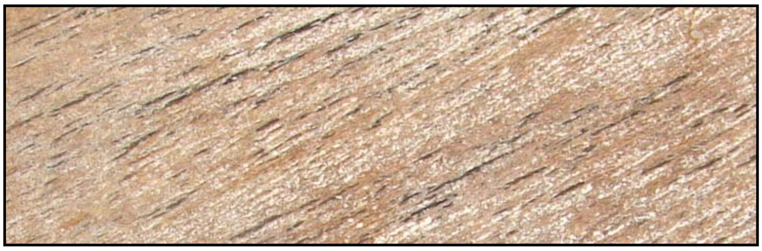


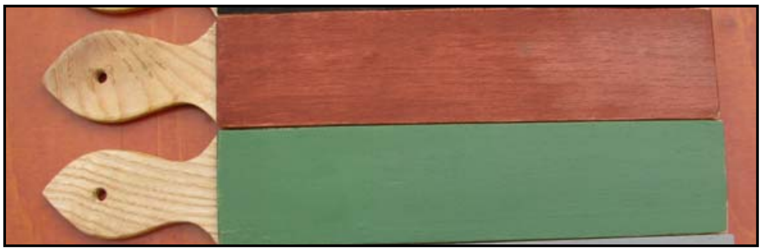














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